ADEC Review of Response to Center for Science in Public Participation (CSP2) Comments (dated 11 July 2005) on the April 2005 Draft DMTS Fugitive Dust Risk Assessment

No.	Comment	Priority	Recommendation	Response	DEC Remarks
CSP2-1	**Important Contaminants were inadequately assessed in the Risk Assessment** The target chemical list was used to select chemicals of potential concern (CoPCs). The target list of chemicals evaluated was based on the list of "concentrate constituents" and excluded bismuth, calcium, chloride, gallium, germanium, gold, silicon, sulfate, and sulfur. The latter chemicals were not included on the list because of the Pareto principle, which states that "... a relatively large number of problems (for example, a large proportion of site attributable risk) in a given situation will be found to be caused by only a few factors (or a few hazardous substances) … the target analyte list [substances] … are those manufactured and used in the greatest amounts and that are the most toxic." All ore concentrate constituents are potential environmental and human health pollutants when they are released in quantities sufficient to cause harm. For example, calcium was eliminated from the target chemical list. Recent research on toxicity of total dissolved solids (TDS) in Red Dog mine effluent to salmonids has shown calcium as one of the major toxic components (Stekoll et al.2003).	Medium	Please respond regarding the need to expand the COPC list to include sulfur and calcium. The specific issue with respect to calcium and salmon should be addressed in the response.	Calcium concentrations in the streams along the DMTS are in the range of 2.3 to 69 mg/L, with a mean of 22.8 and a median of 19.5 mg/L (Table C-7). Calcium concentration in the reference area is in the range of 10.8 to 33.1 mg/L, with a mean of 19.8 and a median of 15.5 mg/L. There is no significant difference between site and reference water concentrations for calcium. These calcium concentrations are well below the lowest observed effects concentration of 250 mg/L identified in Stekoll et al. (2003). Also, calcium contributes to hardness, which reduces the availability of other metals. Adding calcium to the CoPC list for freshwater aquatic environments does not appear to be warranted. The potential for calcium to be causing pH changes in the terrestrial environment along the haul road, and thereby potentially affecting mosses and lichens, was addressed in Section 6.2.3.1 (Coastal Plain and Foothills Mesic Tundra Risk Characterization), starting in the fourth paragraph. In addition, a few sentences were added to the end of the fourth paragraph in that section, and are included below: *Road dust deposition is a regional phenomenon akin to windblown loess from river channels (Walker 1996). Calcareous road dust may raise the surface soil pH and enrich the tundra with nutrients such as calcium and magnesium (Walker 1996). Along the DMTS road corridor, dust was visible or detectable by touch on foliage at all 10 m and 100m stations and at stations up to 150 m from the road along tundra transect TT8 (Photograph 24). Alkaline dust from the road bed material (pH 8.4 at material site MS9) is likely contributing to the elevated tundra soil pH measured at 10-m and 100-m stations (Table 6-15). Figure 4-13 indicates that the tundra soil pH is elevated above reference values (3.6–4.5) well beyond 100 m in the tussock tundra, and that tundra soil pH may not stabilize until nearly 1,000 m from the road. In addition, zinc and lead concentrates have pH values ranging from 7.5 to 8.5 (Teck Cominco 2003b,c), and calcium chloride, applied to the road as a dust suppressant, has a pH ranging from 7 to 10 (Tetra 1998). Therefore fugitive dust may contain concentrates, road bed materials, and calcium chloride, all of which may be contributing to elevated soil pH in tundra surrounding the DMTS road and port facilities.* With respect to sulfur, the National Park Service comments questioned the potential for sulfur to affect lichens. This possibility will be considered in identifying possible future evaluation needs during development of the risk management plan.	Response is acceptable.
CSP2-2:	None of the elements tested as CoPCs were speciated (e.g. chromium or mercury). Elemental forms and speciations should be examined as separate analytes (for example, mercury and methyl mercury in Table 3-3). It is especially important to assess the most toxic forms of compounds for presence and affects.	Medium	Please discuss the issue of speciation more thoroughly in the uncertainty section.	The ERA used the most conservative (lowest) toxicity reference values (TRVs) of those available for different forms of the metals. The TRVs are generally developed from animal studies that used more bioavailable forms of metals than those actually present at the site. For example, the ERA text in the third paragraph of Section 6.5.2 (Effects Characterization) indicates that mercury and chromium were conservatively evaluated as their most toxic forms, and this paragraph is included below. *The form of chromium present at the site has not been analyzed, and therefore mammalian TRVs for hexavalent chromium were used as conservative measures of effects; the uncertainty surrounding this assumption is discussed below in Section 6.6.3.4. Avian chromium TRVs were based on exposure to trivalent chromium, as no suitable TRVs for hexavalent chromium were found. Methylmercury TRVs were selected as effects measures for mercury, because this CoPC is typically in a methylated form in biological tissues (food items), which tend to contribute more mercury to the total exposure than drinking water or incidental ingestion of soil or sediment.* In addition, 100% bioavailability was assumed in the ERA.	Response is acceptable.

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CSP2-3:	Mercury: The Red Dog fugitive dust risk assessment does not speciate mercury, nor does it clearly present what type of mercury analysis was completed; total, elemental, inorganic or methyl mercury. The risk assessment needs to clearly present testing methods and analytical results for all types of inorganic mercury and methyl mercury in sediments and soils. Detection limits for methyl mercury aren't as good as those for elemental, or inorganic mercury (personal communication Dr. Fred Youngs, environmental research chemist, University of Massachusetts Lowell, director of Citizens Environmental Laboratory, Boston). Since no mercury was detected, detection limits may be too high to examine methyl mercury. Further, **table 3-14** notes that detection limits for mercury are "not applicable." As discussed in Dr. Peplow's audit, mercury is very toxic and its presence in the environment is ubiquitous. It is imperative that Teck Cominco adequately evaluate environmental and human health risks from all forms of mercury in the risk assessment.	Medium	Please provide response regarding rationale for not analyzing mercury species at the site and how the current lack of information on mercury species affects the risk estimates for mercury. The response should also address the detection limit issues mentioned above.	Total mercury was analyzed in the risk assessment field sampling programs, and the detection limits were below the screening criteria, as indicated in Section 3.6.1.1 (First Tier Media Screening). In Table 3-14, the entry of "--" (not applicable) in the range of detection limits column was used for mercury and other analytes that were detected in all samples (i.e., when no measurement results were undetected). Regarding speciation and implications for the risk estimates, please refer to the response to comment CSP2-2.	Response is acceptable.
CSP2-4:	Lead: Lead is one of the major contaminants of concern, yet it was eliminated as a COPC in the marine environment because "there was insufficient statistical power to distinguish the mean site concentration from zero (and therefore insufficient power to distinguish it from the reference mean), because of the high variability in lead concentrations. Therefore, a statistical comparison with reference was not made for lead." (Page 3-17) Data supporting this statement are presented in Table 3-12. This statement is confusing. The sample sizes for lead presented in Table 3-12 are N=21 for the reference site and N=129 for the sample sites. This is one of the largest sample sizes used to determine COPCs for any contaminant. The sample size is certainly large enough to determine statistical significance. The high variability of lead concentrations in marine sediment samples is not surprising given the industrial activities in the area. Exponent concludes that based on flawed statistical tests they will eliminate lead as a contaminant of	Medium	Please clarify any confusing statements in this section, explain and defend the statistical methods used, and defend the sediment screening values used.	Statistical comparisons were not made if sample sizes were unsuitable for the comparisons. Statistical methods are described in Section 3.2.8. The comparison of site and reference marine sediments described in this section was done with data collected prior to 2004. However, as agreed upon with DEC, supplemental sediment samples were collected in 2004 from the shiploader area and analyzed for CoPCs as part of the Phase II field sampling and analysis program for the DMTS risk assessment (see Section 4). These data were used to assess current conditions a year after completion of additional shiploader and barge dust controls. The first of two sampling events was conducted in early June 2004, prior to the start of shipping activities at the port site, and the second was conducted during the shipping season (September 2004). All concentrations were below screening criteria for all samples from both sampling events (pre-shipping and during-shipping) in 2004, and thus a site/reference comparison was not relied upon for CoPC screening. Section 4 describes the sampling and provides the 2004 sample results in comparison to screening criteria. This language has been added to the text in Section 3.3.3.1.2, and similar language is included in Sections 3.3.3.2.2 and 3.6.2.5.	Response is acceptable.

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	concern in the marine sediment environment even though the maximum concentrations exceed the Washington State marine sediment standards by an order of magnitude. The maximum site value reported was 5,620 mg/kg dry weight (Table 3-12) and the Washington State marine sediment standards for lead are 450 mg/kg dry weight (Chapter 173-204 WAC SEDIMENT MANAGEMENT STANDARDS, Washington Department of Ecology, Sediment Management Unit December 29, 1995 TABLE 1. MARINE SEDIMENT QUALITY STANDARDS – Chemical Criteria Ch. 173-204 WAC—p.7). Exponent's elimination of lead, one of the primary contaminants in the ore body, due to statistical difficulties is especially disturbing because, by definition, contaminants that exceed sediment criteria are causing risks to the environment and public health. Yet, Exponent doesn't even discuss this problem or seek an alternate method of assessment. They just eliminate the risks from lead from consideration. This must be rectified in a revised risk assessment.				
CSP2-5:	**Metals are bioavailable in the environment, thus their risk is underestimated** The risk assessment does not refer to or acknowledge recent scientific advancements in understanding metal bioavailability. Dr. Peplow discusses several natural biological and chemical processes that result in metals being more bioavailable in the environment than the risk assessment discloses. ACAT (May 2004) also presents a lot of information on bioavailability of lead that has not been acknowledged, discussed, nor incorporated into risk characterizations by Exponent. Recent literature has documented that methyl mercury bioaccumulates in terrestrial habitats (Rimmer et al. 2005). Studies have shown that lead can bio-magnify through the food chain (Woodward et al. 1994). There was no presentation of a scientific literature review on recent advancements in understanding metal bioavailability in terrestrial and aquatic environments. Standard methods to predict mineral speciation, the solubility of oxidized metals, and solubility products using Eh-pH stability diagrams were not used. Similarly, sequential extraction techniques to characterize the relative concentrations of the	High	Please provide response regarding the need to present more information in the RA about the form of lead and other COPCs at the site.	Bioavailability was assumed to be 100% for all metals in the ERA (Section 6.6.3.1.6.) and HHRA, with the exception of lead in the HHRA, for which site-specific bioavailability data are used for comparison with EPA default values. Please see Sections 5.2.2.1, 5.4.1.1, and 5.4.2.1 for discussion of bioavailability in the HHRA.	Response is acceptable.

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	different forms of the metal compounds and the potential bioavailability were not used. Underestimating bioavailability of heavy metals in the environment and food web lead to a grave underestimation of the risks from Red Dog's fugitive dust releases. Exponent's risk assessment inadequately addresses these issues and thus may greatly underestimate risks to the environment, subsistence users and workers.				
CSP2-6:	**Air quality monitoring conducted by Teck Cominco 1991-1994, and between October 2004 and present, was not discussed** This data could be helpful in assessing the distances fugitive dust travels, or where and when it accumulates, in particular when compared with wind or weather data. Past data should be compared, where possible, to current and future dust deposition data.	Medium	Please summarize the air monitoring data results.	Information from various air monitoring related programs at the port site is summarized in the Fugitive Dust Background Document (DEC et al. 2002). While these programs provided some illustration of sources and deposition patterns in the port areas, the best overall indicator of dust deposition is the moss dataset. Moss is the medium which most integrates deposition over time and incorporates variable meteorological conditions. The moss dataset also has a relatively complete spatial coverage, and thus best illustrates the spatial patterns of time-averaged deposition. *DEC, Teck Cominco, and Exponent. 2002. Draft fugitive dust background document, DeLong Mountain Regional Transportation System, Alaska. Alaska Department of Environmental Conservation, Anchorage, AK; Teck Cominco Alaska Incorporated, Anchorage, AK; and Exponent, Bellevue, WA.*	Response is acceptable.
CSP2-7:	**The retention of metals in roots rather than shoots of plants was not considered during sampling** All sampling of plants (terrestrial and aquatic) was done through the shoots, or the most recent of the plants' growth. However, it has been shown that as much as eighty percent of lead taken up by a plant can be retained in its roots (Vogel-Mikus et. al. 2005). Therefore the amount of contaminates retained in plants as given in the risk assessment may be misleading. Considering this information, it should also be determined whether or not subsistence users consume the roots of any plant.	Low	Please evaluate the reference provided to determine its applicability. If it is applicable, please add the appropriate discussion in the uncertainty section.	Metals dust deposition occurs on plant surfaces, and concentrations decrease with depth in the tundra profile; therefore, concentrations are likely to be lower in plants' root zones. Additionally, for the HHRA, even if metals are more concentrated in sourdock roots and those roots are consumed by people, the very small contribution of vegetation to the subsistence diet (less than 0.2 percent) means that the effect on overall risk estimates would be undetectable. Note that mosses and lichens, which are also ecologically relevant in the study area, are non-vascular and do not have roots.	Response is acceptable.
CSP2-8:	**The effects of metal mixtures on toxicity and bioavailability are not considered** All sampling sites (terrestrial and aquatic) showed the presence of several heavy metals in combination. Scientific literature has documented that the toxicity of heavy metals interact in a number of ways. Metal mixtures can affect bioavailability and bioaccumulation. Youn-Joo et. al. (2004) found that "Binary metal combinations of copper and cadmium, copper and lead, and cadmium and lead produced three types of interactions: concentration additive, synergistic, and antagonistic. …bioaccumulation of one metal was influenced by the presence of other metals in metal mixtures."	Low	Please provide response to the issues of metals interactions described in this comment.	Although it is possible that interactions between combinations of metals could result in differences in bioavailability and/or toxicity relative to individual metal exposures, these potential interactions are poorly characterized, at best. Furthermore, the effect of the interaction could be positive or negative. For example, zinc can reverse cadmium-induced toxicity (Peraza et al. 1998). According to EPA guidance, cumulative risk assessment should consider the combined health effects of a group of chemicals with a common mechanism of action, defined as two or more chemicals "that produce an adverse effect(s) to human health by the same, or essentially the same, sequence of major biochemical events. The underlying basis of the toxicity is the same, or essentially the same, for each chemical" (US EPA 1998). Thus, risks from multiple chemicals should only be summed if those chemicals operate through the same mechanism. DEC (2002) guidance provides the same direction, indicating that cumulative risk should be addressed by calculating a hazard index (HI), where "HI is the summation of all of the [Hazard Quotients] for all pathways and exposure routes that affect the same target organ or system endpoint." Nevertheless, as a conservative measure the HHRA	Response is acceptable.

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	This phenomenon is further complicated by inter-element interactions that affect the minimum needs and maximum tolerances of organisms to toxic elements. Two-way and three-way metal interactions have been described that alter their toxicities. The variability of toxicity among and between metals to various taxonomic groups differs depending on the environmental conditions. These complex interactions increase the risk of toxicity to receptor species and organs. Although these interactions have not been quantified and captured in water and sediment quality criteria, their contribution to the overall environmental and human health toxicity must be acknowledged in the risk evaluation. Changes to toxicity and risk must be quantified using state of the art techniques and presented in a revised risk assessment. Otherwise, risks to the environment, subsistence users and workers are being knowingly underestimated.			presented cumulative HIs combining HQs from all chemicals and all pathways, regardless of the lack of shared toxicological endpoints. Bioavailability was conservatively assumed to be 100 % for all metals in both the HHRA and the ERA, with the exception of lead in the HHRA. For human exposure to lead, risks were evaluated assuming both the conservative default value recommended by EPA where site-specific information is not available, and the site-specific value determined for Red Dog concentrate. The modeling technique used in the ERA evaluates each chemical individually, because the TRVs used for evaluating the ecological significance of exposure are also chemical-specific. Chemical-specific HQs calculated by this method permit identification of specific chemicals that may cause adverse effects in ecological receptors. Simultaneous exposure to multiple chemicals could produce cumulative effects that are greater than the effects predicted for individual chemicals. However, to determine this requires a detailed understanding of mode of action and target organ for each chemical in each receptor. Simple approaches such as summation of individual HQs to calculate an HI are sometimes used to estimate cumulative effects; however, this assumes effects are additive, which may not be true based on the chemical-specific modes of action, and may be an overly conservative approach if some metals act antagonistically. Furthermore, multiple lines of evidence were evaluated in the ERA, including results of vegetation community surveys, stream benthic invertebrate surveys, and toxicity tests, to provide an indication of the magnitude of effects from cumulative exposure to multiple metals in soil, sediment, or water, as well as from other anthropogenic or natural stressors. Please refer to Sections 6.6.5.4 (Toxicity Reference Values), formerly referred to as Section 6.6.3.4. *Peraza et al. 1998. Effects of micronutrients on metal toxicity. Environ Health Perspect. 106 Suppl 1:203-16.*	
CSP2-9:	**Reference areas are not appropriately chosen** Sites should be located farther away from the DMTS, in a geographically separate area. There is discussion of the separation provided by a mountain range south of the haul road in the 2004 NPS survey. Further, the location of reference sites should not be based on their situation on the "prevailing upwind" side of the road. Winds don't always blow from the south, especially in the summer (TCAK 2005, figures 8 and 9) when fugitive dust is not captured within the snowpack, and so is at its most mobile. Also, trends in wind direction vary greatly from year to year (personal communication Colleen Swan to Amy Crook, June 14, 2005). Thus these "upwind" sites aren't references, but could and should be subjects of another study, a comparison between north and south transects along the haul road.	High	Please provide rationale for selection of reference locations. Are the points raised valid?	Particulates are likely to be most mobile during the winter, when wind speeds are greatest, and particulate generation may be greatest during the winter as well, when the air has the lowest moisture content, and watering cannot be used on roads. Wind speeds are much lower during the summer, and the uneven surfaces of tundra vegetation are more apt to capture particulates, further limiting particle travel distance during the summer (Fugitive Dust Background Document, DEC et al. 2002). *DEC, Teck Cominco, and Exponent. 2002. Draft fugitive dust background document, DeLong Mountain Regional Transportation System, Alaska. Alaska Department of Environmental Conservation, Anchorage, AK; Teck Cominco Alaska Incorporated, Anchorage, AK; and Exponent, Bellevue, WA.* Additional figures and discussion of the NPS/Hasselbach data have been added in Section 1.1 describing nature and extent of fugitive dust deposition. The composite map of moss data referenced therein best illustrates the temporally averaged depositional patterns around the mine, road, and port. The revised Section 1.1 is included below: *Moss studies performed in 2000 and 2001 by the National Park Service (NPS) (Ford and Hasselbach 2001, Hasselbach 2003b, pers. comm., Hasselbach et al. 2005) found elevated concentrations of metals in tundra along the DMTS road and near the port, apparently resulting from fugitive dust from these facilities. A fugitive dust study completed by Teck Cominco in 2001 (Exponent 2002a) provided an initial characterization of the nature and extent of fugitive dust releases from the DMTS corridor and provided baseline data from which to monitor the performance of new transport and handling equipment and dust management practices. A fugitive dust*	Response is acceptable.

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				background document was published in spring 2002, providing an overview of local observations and concerns, local and regional background information, Red Dog operations, regulatory history, environmental data, nature and extent of fugitive dust, a preliminary conceptual site model for the risk assessment, and review of regulatory and decision-making frameworks for addressing the fugitive dust issue (DEC et al. 2002). *Teck Cominco completed additional characterization at the port site in 2002 (Exponent 2003b; Teck Cominco 2003). Sampling programs designed to support the risk assessment were conducted in 2003 and 2004 to obtain data for additional analytes in multiple environments and media. These programs are described in the field sampling plans (Exponent 2003e, 2004a), and in Appendices A and E of this document.* *The nature and extent of dust deposition has been evaluated in these prior studies by Exponent and NPS, as listed above. Some key observations are summarized here:* • *Moss data collected during various sampling efforts by NPS and Teck Cominco, when presented together (Figure 1-9), effectively illustrate the primary source areas and deposition patterns in the vicinity of the DMTS corridor and mine. The moss concentration patterns illustrate how the prevailing wind patterns originating from the southeast to northeast result in greatest deposition to the north and west of the DMTS and mine facility areas.* • *Within the DMTS facility areas, metals concentrations decrease away from facility sources (Figure 1-9), and vary along the length of the road corridor, with the highest concentrations near the port and the mine, as a result of concentrate tracking that has historically occurred with haul trucks exiting the concentrate storage buildings at the mine and port (Figure 1-10).* *Many improvements have been made over the years by Teck Cominco to reduce fugitive dust emissions. Broadly, these include improvement to engineering controls and enclosures around ore crushing, milling, concentrate storage, and loading operations at the mine, as well as concentrate trucking and storage, conveyance, bargeloading, and shiploading facilities at the port. In addition to physical dust control improvements, procedural improvements have been made as well. Further description of these measures, as they pertain to the risk assessment conceptual site model, is provided in Section 2.2.4. Teck Cominco continues to work on additional dust control improvements on an ongoing basis.* The uncertainty assessment in Section 6.6 has been updated with additional discussion regarding selection of reference areas, uncertainties associated with the reference area data, and their use in the assessment (including implications for CoPC selection). Section 6.6.1 (Uncertainties Related to Reference Area), which includes the additional discussion of reference areas, is provided in its entirety below: ***6.6.1 Uncertainties Related to Reference Area Selection*** *This section describes the selection and use of the reference areas in the risk assessment, reviews uncertainties about the reference area data, and discusses implications of these uncertainties for the use of the reference area data and the findings of the risk assessment.*	

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				6.6.1.1. Terrestrial Reference Area *Terrestrial reference areas were selected after review of existing studies and data, with a focus on factors such as prevailing wind directions, bedrock geology, topography and physiography (including slope, aspect, and water features such as streams and tundra ponds), and plant and animal communities. Possible reference areas were considered to the east, north, west, and south of the mine and DMTS. The prevailing wind originates from the east, between the northeast and southeast quadrants; thus, the most significant dust deposition has occurred to the north and west of the DMTS road and mine. As a result, areas to the north and west were not preferred areas for establishing the terrestrial reference area. Areas to the east were eliminated because the topography is more mountainous than most of the DMTS area. Thus, the focus was on selecting an area to the south of the mine and DMTS road. However, selecting an area too far south would have put the reference area into the Noatak valley, where the plant community includes trees and would not be as good for comparison with plant communities at the site. Therefore, the terrestrial reference area was targeted for placement somewhere within several miles south of the DMTS. Within that band south of the DMTS, the selected area was to be in a geologic area known to be relatively free of lead/zinc base metal mineralization. The selected area also needed to contain a variety of topographic conditions (elevations, slopes, and aspects), streams and ponds, and plant communities, providing the opportunity to sample environments similar to those along the length of the DMTS road. Based on these criteria, the Evaingiknuk Creek drainage was selected as the best choice. This basin met the most criteria, and had low base metal mineralization compared with other possible reference locations that were considered to the south of the DMTS.* *Subsequent to the selection of the Evaingiknuk Creek drainage as the terrestrial reference area, sampling was conducted in two phases. The first phase included sampling of moss, which, when included with the overall moss database (including the NPS data, Ford and Hasselbach 2001, Hasselbach 2003b, pers. com., Hasselbach et al. 2005) and plotted together, provided a clearer perspective on overall patterns of deposition in the areas surrounding the DMTS and mine (Figure 1-9). Prior to the first phase of sampling, no moss data were available in that area.* *The mean lead concentration for the three moss samples in the reference area is 8.0 mg/kg. Tundra soil was also sampled in the reference area, and the lead concentration ranged from 2.9 to 23.3 mg/kg, with a mean of 8.9 mg/kg, very similar to the mean moss lead concentration. In the area beyond approximately 16 miles north of the DMTS, where there is no apparent trend in the NPS moss concentration data, the mean lead concentration in moss is 8.5 mg/kg, or 6.4 if one outlier duplicate sample is excluded (Dixon's outlier test was used to confirm that the 38.6 ppm lead result is a statistical outlier at the 0.05 level [$0.02 < P < 0.05$]). The concentrations in the reference area and the area beyond 16 miles north of the DMTS appear to be similar. In the southern extent of Cape Krusenstern National Monument (CAKR), beyond 12 to 13 miles south of the DMTS, the NPS moss lead concentrations average 2.0 mg/kg. It should also be noted that the area surrounding the Red Dog district is more mineralized than the southern part of CAKR. If there were dust depositional influence in the reference area, or the northern extent of the data collection area, it would appear to be very limited.* *The communities in the reference area appear to be healthy, unimpaired communities suitable for use in reference/site comparisons. Even if there were some evidence*	

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				suggesting low-level deposition in the reference area, the potential for this dust deposition to cause adverse effects to receptors is minimal. The metals concentrations in moss and lichens were very low; copper and zinc concentrations were far below effects levels reported in the literature (e.g., see Tables CK1 and CK2 for moss and lichen comparisons with threshold values). Furthermore, in almost every case, metals concentrations in terrestrial sedge and shrub samples were below phytotoxicity thresholds, even though samples consisted of unwashed tissues (Tables 6-17 and 6-18). Lead and zinc exposures for all wildlife receptors were uniformly low and never exceeded toxicity reference values (TRVs) in the terrestrial reference area. Hazard quotients did exceed 1.0 for some receptors in the reference area, particularly for aluminum and barium, although as discussed in the risk assessment, this appears to be a function of the conservative nature of the TRVs for these metals rather than their concentrations in reference area media. For example, aluminum concentrations in reference area moss were similar to or less than concentrations in the southern extent of the CAKR, many miles further away in a prevailing upwind direction from the DMTS. This would suggest a similar level of risk would be predicted from aluminum in south CAKR. However, because south CAKR is well beyond the potential influence of the DMTS, it just illustrates the overly conservative nature of the aluminum TRV. ***6.6.1.2. Coastal Plain Reference Area*** *In the second phase of sampling, a plant community assessment was conducted, and in order to better match the coastal plain plant community at the port, an additional reference area was selected south of the port in the CAKR (sample station TS-REF-12). Although moss was not collected at this location, tundra soil had a lead concentration of 5.8 mg/kg, slightly lower than the 8.9 mg/kg concentration in the terrestrial reference area.* ***6.6.1.3. Reference Lagoons*** *The reference lagoons included the Control Lagoon, approximately 2 miles south of the port, and an unnamed lagoon approximately 5 miles south of the port. The Control Lagoon was established as a reference in early port site studies (ENSR 1990), and the unnamed “Reference” lagoon was added during the first phase of the risk assessment sampling efforts (Exponent 2003e). At these distances, any depositional influence would be small, given prevailing wind directions. Mean sediment concentrations (from the 2003 and 2004 sampling events) in the two lagoons at different distances from the site are almost identical, with lead 9.6 and 9.5 mg/kg, zinc 86.6 and 86.9 mg/kg, and cadmium 0.2 and 0.3 mg/kg in the Control and Reference lagoons, respectively.* ***6.6.1.4. Marine Reference Area*** *The marine reference area is located approximately 3 miles to the south of the port. Sediment samples were collected there during several marine sampling events. Even if there were any depositional influence this far south, the influence would be very slight, and would likely be largely dissipated by dynamic ocean action, including wind, waves, and prevailing northward currents. Regardless of whether there is any detectable influence at the marine reference area, site sediment data from recent sampling events have been below all available screening thresholds, as described in Section 4.3.*	

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				6.6.1.5. Effect of Uncertainties *There are clearly uncertainties with regard to the potential influence from dust deposition on reference areas. However, the possible effect of these uncertainties on the analyses, such as comparison of site and reference area conditions, appears to be limited. Based on the discussion in Section 6.6.1.1, there is very little if any measurable depositional influence from the mine within the terrestrial reference area. Thus, the possible influence of mine dust deposition in the reference area is so small as to be highly unlikely to result in any incremental effects to receptors in that area. Therefore, comparisons of communities (e.g., benthic and plant communities) at the site with those in the reference area are acceptable for the analyses. Further discussion of uncertainty related to the use of reference area comparisons in CoPC selection is included below in Section 6.6.3.* ***6.6.1.6. Summary*** *While all of the reference areas are suitable for the risk assessment, there are clearly some uncertainties with regard to the potential influence from dust deposition. The possible need for additional study to further address these uncertainties will be considered during development of a risk management plan.*	
CSP2-10:	**Section Specific Comments:** **2.2.1 Road surface runoff** is "inhibited by interactions with organic materials in the tundra." Does this mean that it goes into the plants? Why isn't this discussed later, as a potential cause for concern? How far does this runoff go (especially under different weather conditions)? See discussion of section **6.7.2** **2.2.2 Port surface runoff see discussion of 2.2.1**	Low	Please clarify section.	The potential exists for contaminants to be taken up by plants. However, if this happens, plant tissue concentrations would reflect that uptake. Plant tissue samples were collected and used in the food web models to reflect exposure to receptors that consume plants. Additionally, effects on plant communities were evaluated in the vegetation community analysis within the risk assessment. Regarding "runoff," if metals were to run off the road to surface water drainages, or to migrate from the tundra to surface water drainages, the transport would be reflected in water quality samples taken from those drainages. These surface water data are used in the risk assessment, thus incorporating exposures as a result of those transport pathways.	Response is acceptable.
CSP2-11:	**2.2.4 Fugitive dust control measures** this section is unclear, and doesn't distinguish between *past* contamination and *potential* contamination (risk).	Low	Please clarify section.	Section 2.2.4 has been clarified in a chronological manner, and the revisions are included below: *The fugitive dust transport mechanisms described above have been subject to changes resulting from ongoing efforts to reduce emissions. These changes are a result of dust control measures taken with facilities in the mine area, with trucking on the road, and with unloading, storage, transfer, bargeloading, and shiploading facilities at the port. The changes include the use of newer trucks, significant upgrades to the surge bin and truck loading and unloading facilities, and full enclosure of the conveyers between the surge bin and the CSBs. In addition, significant modifications were made in 2003 to the barges and the shiploader, including full enclosure of the shiploader conveyor, and installation and upgrade of baghouses to actively collect dust within the barge conveyor system. Truck tracking has been reduced by improved dust control in the loading and unloading buildings, and by truck washing in the summer and traffic separation at the mine. Since fall of 2001, concentrate spillage and escapement has been significantly reduced by newer trucks that produce less dust when unloading, have better handling characteristics to reduce the likelihood of roll over, and have hydraulically closed steel covers and solid sides to prevent concentrate from escaping during normal transit or in the event of an accident. Efforts to minimize transport mechanisms from the DMTS road surface include physical and procedural controls implemented to limit tracking, as well as recovery and recycling of*	Response is acceptable.

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				metals-containing road material. Improved dust control procedures have been instituted within the CSBs to reduce fugitive dust emissions during unloading and handling of the concentrates, and the conveyors and surge bin have been upgraded to reduce concentrate spillage and dust leakage from these facilities. The shiploader conveyor and the conveyer on the barge have also been upgraded with more complete enclosure and dust control systems. Efforts to reduce fugitive dust emissions are ongoing. A chronologic summary of dust control improvements is provided in Appendix L. *Fugitive dust control improvements have also been made in the mine area. In 1992 a significant number of control measures were implemented. The coarse ore stockpile was enclosed to prevent the escape of fugitive dust, the mine concentrate storage building was modified to include a loading bay to reduce tracking, take-up pulleys were relocated to inside the mill or enclosed in place, and a large water truck was purchased to facilitate implementation of additional dust control measures (watering and palliative application) on roads and yards. More recently, a procedural change was made to keep the water in the tailings impoundment at a higher level, such that tailings impoundment sediments remain covered by water, thereby eliminating dust from windblown sediments. Additional dust controls have also been implemented in the truckloading at the mine CSB, to minimize dust getting on the exterior of the trucks and to reduce tracking from the mine. Traffic separation was implemented in 2004 to separate DMTS road traffic (e.g., concentrate haul trucks) from mine area traffic (e.g., mine vehicles and equipment). A more detailed list of dust control improvements at the mine is provided as an appendix in the recent document Summary of Mine-Related Fugitive Dust Studies (Teck Cominco 2005), and included in Appendix L of this document. Other possible control measures are being evaluated in an ongoing effort for continual reduction of fugitive dust emissions from mine, road, and port facilities.*	
CSP2-12:	**2.3.3.1 Worker and subsistence use in the terrestrial environment** ADPH 2001 and Exponent 2002a were preliminary studies, and tested different sites than did the 2004 testing conducted by Exponent and summarized in appendix H. A statistical analysis (as discussed in the Methods section of appendix H) should not be used to equate all of the tested sites, as relatively few sites have been tested. When so few data points are available, results cannot be statistically significant.	Low	Please clarify section to ensure that there is no confusion about the applicability of any of these studies.	One of the sites included in the 2004 sampling effort, Ipiavic South, was also sampled in 2001. This site was selected as part of the 2004 study partly to allow comparison of concentrations over time. The new sites at Kivalina South and Kivalina North were selected in order to evaluate whether there was a spatial trend in berry or sourdock metals concentrations. It is true that small sample size may result in a lack of adequate statistical power to detect statistically significant differences. However, in most cases the range of concentrations was very small and, based on the results of the risk assessment, any differences that might be detected if more samples were available would be irrelevant from a public health perspective. As noted in Section 5.4 of the risk assessment, risks for berry and sourdock consumption were very low even when concentrations from samples harvested near port facility areas were included.	Response is acceptable.
CSP2-13:	**2.3.3.1.3 Dermal contact with metals in soil** USEPA 2004 says that other minerals' dermal effects should be measured 'qualitatively'; what are the ways in which subsistence gatherers/area residents could be exposed to lead through their skin? E. g. through showers, swimming, gathering berries. This should not be dismissed as a primary pathway; as discussed in Peplow (2005) designation of primary pathways was decided without detailed reasoning.	Medium	The rationale for determining whether a pathway was designated as primary or secondary should be clearly presented.	Discussion of the primary and secondary exposure route designations for the HHRA is provided in Section 2.3.3 (and subsections). A specific subsection (2.3.3.1.3) is devoted to the rationale for designating dermal contact with soil as a secondary, rather than a primary, pathway. For the ERA, the discussion is provided in Section 2.4.4.	Response is acceptable.

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CSP2-14:	**2.3.3.2 Subsistence and residential use in the freshwater environment** dismisses quantification of exposure through drinking water and/or fish consumption based on previous studies, which aren't cited in this section and may or may not be reliable.	Low	Please provide requested references.	The text in Section 2.3.3.2 indicates that both water consumption and fish consumption are retained as primary exposure pathways in the HHRA. Consequently, quantitative risk estimates were calculated for these pathways. However, Figure 5-1 in the draft HHRA inadvertently presented a preliminary conceptual site model rather than the refined conceptual site model. The revised conceptual site model includes stream water and fish ingestion as primary pathways. The errors in Figure 5-1 have been corrected in the revised HHRA, and the revised Figure 5-1 is attached to this document. In any case, both pathways were treated as primary exposure pathways in the draft risk assessment. The CoPC screening identified lead and thallium as freshwater CoPCs and potential risks from fish consumption and water ingestion were estimated.	Response is acceptable.
CSP2-15:	**2.3.3.3 Subsistence use in the lagoon and marine environments** should also discuss anadromous fish (chum, char), as it is mentioned on p 2-20 that lagoons open to the ocean are important habitats for these fish. Notes from a meeting in Kivalina (20 April 2005) indicate that two lagoons were seined to check for fish during one field study; during what season were they checked? Assurances should be made that fish do or do not spend time in these lagoons, as the statement made on p 2-20 directly contradicts a statement made by Scott Shock in Kivalina.	Low	Please provide the requested information.	Onsite lagoons are not connected with the Chukchi Sea, but instead are isolated, and freeze solid during the winter, These on-site lagoons were seined as part of the risk assessment sampling program as described in Appendix E, However, fish were not present in the onsite lagoons. Lagoons that are offsite were not sampled.	Response is acceptable.
CSP2-16:	**2.4.4 Potential exposure pathways** the primary exposure pathways for aquatic receptors should include not only contact or consumption of surface water, consumption of prey, or contact with sediment, but also contact or consumption of water at any depth; this is particularly important in deeper lagoons and/or offshore, where currents are stronger and may pull surface contaminates to a different depth. Currents may also change seasonally.	Low	Please explain that surface water refers to all parts of a surface water body as opposed to groundwater.	The primary exposure pathway for aquatic receptors includes water from the entire water column, and does not exclude deeper water portions. In this document, surface water refers to all parts of a surface water body.	Response is acceptable.
CSP2-17:	**2.4.6 Preliminary assessment and measurement endpoints** compares data with toxicity reference values "derived from the literature." What are these values?	Low	Please amend the text so that it points to the location of these values.	Text was added to Section 2.4.6 referencing the location of the TRV discussion and data tables.	Response is acceptable.
CSP2-18:	**3.1 Target chemical list** DEC's requirement of pH data tells the reader about what risk? This section should explain why a low pH would indicate whatever it does, not only that measurements were taken. Further, it should cite where that data is.	Low	Please amend the text to include the requested information	Tundra pH may be influenced by road dust deposition and may contribute to effects on plant communities, thus the need for measuring pH in tundra environments. The text in the third paragraph of Section 3.1 was amended to include this information, and the revised text is included below: *However, as agreed upon in discussions with DEC, pH was measured on tundra soil samples and at all surface water bodies where sampling was conducted in the 2004 field season (see Section 4). Tundra pH may be influenced by road dust deposition and may contribute to effects on plant communities, thus the need for measuring pH in tundra environments. Recognizing that pH will likely vary naturally in different tundra environments, pH was also measured at reference area stations to provide data for further comparison and evaluation. Section 4 discusses the supplemental data collection for the risk assessment data needs.*	Response is acceptable.

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CSP2-19:	**3.2.2 Data usability, Sample depth** Why were deeper samples not also considered? Fugitive dust has, to some degree, existed since the beginning of mining operations; samples at varying depths could potentially indicate the movement of contaminates originating from the mine through soil over time (since 1989).	Low	Please provide evidence or rationale why deeper samples are not necessary.	Surface soil samples were used in the risk assessment rather than subsurface soil samples because surface soils are where the dust accumulates, and where exposure occurs. This is conservative (i.e., protective) because the surface soil concentrations are generally higher. In addition, ecological receptors are exposed to chemicals in surface soils in the course of their foraging.	Response is acceptable.
CSP2-20:	**Data quality review** data sets that are not validated should not be used, particularly if they are of lesser importance to begin with "Although some of the analytes have a limited number of sample results, the chemicals that have greater sample coverage (i.e., lead, zinc, and cadmium) may be used as indicators for the spatial distributions of the associated chemicals." What chemicals are associated? How can they be used as indicators for other chemicals? Is this discussed further/cited? How does it work?	Medium	Please clarify the use of unvalidated data.	Validated data sets were used for the assessment, but were supplemented with non-validated data sets. The text in the fifth bullet of Section 3.2.2 was clarified, as follows: ***Data Quality Review—****Data used in the CoPC screening and available for use in the risk assessment have been validated and qualified as part of a normal quality assurance review process. The quality assurance review for the 2003 risk assessment data collection program is provided in Appendix B. A few data sets of lesser importance for the risk assessment were not validated. These included some of the stream water data and port site soil data collected in 2003 by Teck Cominco (Teck Cominco 2003); however, the most important stream water data sets were validated (i.e., the September and October 2003 data sets, for which most or all of the target chemicals were analyzed). Other sets without the full target chemical list (i.e., the months of May through August 2003) were not validated. The Teck Cominco (2003) soil and tundra soil data sets were not validated because there was already significant coverage of these areas with data sets that were previously validated.*	Response is acceptable.
CSP2-21:	**3.2.3 Terrestrial environment** should describe/include photos of 'inorganic' soil sites; these sites might have been contaminated (according to Bob Winfree, these sites are places from which fill was taken for other projects [pers. comm. 13 June 2005]) Sites should include samplings away from the road (see discussion of section **5.2.1.1**) It should be noted that the majority (provide a number) of both sets of soil samples were taken from in and immediately around the port's ambient air boundary.	Low	If photos of the sites are available, please include in an appendix. (The remainder of the request is included in the document).	Inorganic surface soils are found primarily in road and facility areas (e.g., gravel roads and pads). These areas were generally the areas with the highest concentrations, where ore concentrate tracking was likely to occur. Text was clarified. Although photographs of the inorganic soil sites were not taken and are therefore not available, Figure 3-2 shows sample locations, as indicated in the text.	Response is acceptable.
CSP2-22:	**3.2.4 Streams** should have sampled more waterways. In particular, sampling should encompass the entirety of the Wulik watershed, because the village of Kivalina sits at the mouth of the whole of the watershed. Should describe physical characteristics of ■ Sediment (and environment of sediment e.g. rocky over sand/all sand) ■ Speed of water (easier to measure) / turbulence (harder to measure, but important when taking only surface samples) Why were samples not taken at any depth? In particular in smaller streams nearer to the edges of a watershed, like those closest to the DMTS, water will turn over often, rolling over rocks and catching	Medium	Please provide response about the need to sample additional streams.	Surface water samples were collected close to the road/stream crossings in order to obtain the highest possible concentrations. Thus, these water samples are conservative (i.e., protective) relative to water quality further downstream. Surface water samples integrate water throughout the depth of the water column, and therefore should be representative.	Response is acceptable.

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	air. Rather than moving as a wide, slow river, streams will fold in dust, moving it away from the surface and eventually into the sediment that feeds plants in or near streams. Most of the stream study sites are located within the park, not many up closer to the mine site. Does this bias the concentrations low?			Stream samples were collected in multiple locations along the road, both within and outside the park. Streams within the park are in closer proximity to the port site, and thus subject to truck tracking of concentrates from the port site. The data do not indicate any bias present in park area stream samples.	
CSP2-23:	**3.2.5 Tundra ponds** Sediment and water samples: give distance from road on either side. Transects *should* have been continued farther beyond the road, and more transects should have been tested. Pending this, uncertainty presented by a small sample size should be discussed.	Medium	Provide additional discussion in the uncertainty section about the sample size.	Sediment and water sample locations and distances from the road are shown on Figure 3-4. Discussion of the sample collection and field modifications is included in Appendices A and E. As discussed in Appendices A and E, tundra pond stations were located at varying distances from the road (i.e., pond transects), and at locations along the length of the road (i.e., near the mine, middle of the road, and toward the port) to evaluate gradients of CoPC concentrations in relation to potential sources. Extensive searches by field staff located fewer tundra ponds than the number originally planned to be sampled (Appendix E). Section 6.6.2 describes uncertainty associated with small sample sizes.	Response is acceptable.
CSP2-24:	**3.2.7 Marine environment** should discuss the potential for currents to make these samples say very little; should include map/chart of currents. Why does site marine water not include offshore samples? This should be discussed. Reference sites are too close to the port site ambient air boundary to act as true reference sites, especially considering intensity of air and water currents along this coast.	Medium	Please provide response regarding justification for location of marine sediment sampling sites, rationale for not collecting off-shore samples, and appropriateness of marine reference sites.	As described in Appendix E, the marine station locations were selected primarily on the basis of historical evaluations (RWJ 1997; Exponent 2003b, 2004b) and offshore current patterns (prevailing current is northward) and were designed to allow evaluation of possible gradients of CoPC concentrations in relation to potential sources, as well as potential temporal changes in CoPC concentrations (i.e., by resampling stations from previous studies). The marine reference area is located approximately 3 miles to the south of the port, in the prevailing upwind and upcurrent direction. Sediment samples were collected there during several marine sampling events. Even if there were any depositional influence this far south, the influence would be very slight, and would likely be largely dissipated by dynamic ocean action, including wind, waves, and prevailing northward currents. Regardless of whether there is any detectable influence at the marine reference area, site sediment concentrations from recent sampling events have been below all available screening thresholds, as described in Section 4.3.	Response is acceptable.
CSP2-25:	**3.3.1.2 Comparison of site data with risk-based screening values** utilizes chemical-specific reference doses. Where are these doses listed? Where do they come from?	Low	Please point to the references.	Most chemical-specific cancer slope factors (CSFs) and reference doses are provided in DEC (2002). For those chemicals not listed in DEC (2002), CSFs and/or RfDs were taken directly from U.S. EPA (2005).	Response is acceptable.
CSP2-26:	**3.3.3 Costal lagoon and marine environments** "a comparison to chemical concentrations in lagoon and marine water from areas not affected by the DMTS." Cite 1) what those areas are and 2) how we know they're 'not affected.	Low	1) Please provide reference to a map with reference locations 2) Duplicate of comments on reference areas.	Figure 3-1 illustrates the terrestrial, lagoon, and marine reference sampling areas. Please see response to comment CSP2-9 regarding reference area selection.	Response is acceptable.
CSP2-27:	**3.3.3.1 Comparison of Site Lagoon and Marine Data with Reference Data** The sample sizes for reference samples were very small (N=3). The statistical analysis would have had more power if the sample sizes were increased. Exponent needs to discuss what effect small sample size had on being able to detect statistical significance. "A statistical comparison to reference could not be	Medium	Please supplement the uncertainty section with the drawbacks of having a small sample size.	In the statistical comparison tables (e.g., Table 3-11), comparisons were not made if sample sizes were unsuitable for statistical comparisons. Please refer to the screening tables that follow the statistical comparison tables for sample sizes and detection frequencies (e.g., Table 3-25). Section 3.2.8. (Comparison of Site Data with Reference Data) discussed statistical comparisons, and discussion of the ability to detect differences was included. Section 3.2.8 text with revisions is below:	Response is acceptable.

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	made for mercury, selenium, tin, or vanadium, because there were too few detections in site and reference data." This statement refers to Table 3-11. No sample size was given in this table for reference or site samples for these contaminants. How many samples were taken for analysis?			***Comparison of Site Data with Reference Data*** Comparisons between site and reference area concentrations were conducted using an analysis of variance (ANOVA) model followed by a multiple comparison test. Differences were also assessed using the Wilcoxon rank-sum non-parametric test. Both the Wilcoxon and the multiple comparison tests were one-sided tests for whether the site concentration was significantly greater than the reference. Significance was determined at a 0.10 level (alpha=0.10) to increase the likelihood of detecting differences (i.e., to increase the power of the test). The ANOVA method is more powerful than the non-parametric test, but underlying assumptions of equal variance and normality must be met. Method assumptions were evaluated using residual plots and normal probability plots. Even spread in the residual plots shows that the homogeneity of variance assumption was met and a straight line on a normal probability plot of the residuals indicates the normality assumption was met. In cases where the results for parametric and non-parametric test methods did not agree, the underlying assumptions were scrutinized further to determine which method was most reliable for each case. In cases where greater than or equal to 50 percent of site data values or 100 percent of the reference values were undetected, statistical analyses were not performed. Also, if the 90 percent confidence interval for the site mean concentration spanned zero due to small sample size and/or high variability, comparisons were not made. The results of the statistical comparisons are provided in Tables 3-4 through 3-13. The importance of the site-reference comparisons to the selection of CoPCs varies by analyte, and is discussed below in the CoPC screening and selection sections.	
CSP2-28:	What type of mercury was analyzed for? In sediment methyl mercury should also be sampled for besides inorganic mercury because of its toxicity and bioavailability in the environment. Was the mercury analytical technique capable of measuring both methyl mercury and inorganic mercury?	Low	Please clearly describe the type of the mercury that was analyzed.	Total mercury was analyzed in all samples. This is inclusive of all forms of mercury, including methylmercury and inorganic mercury. Detection limits were below the screening criteria, as indicated in Section 3.6.1.1 (First Tier Media Screening).	Response is acceptable.
CSP2-29:	**3.3.3.1.1 Lagoon environment** doesn't make it clear that the first set of samples it discusses are reference samples, while it discusses the comparison later. Throughout the document, reference sites are said to be "in the prevailing upwind and upcurrent direction." Where is this shown? Who monitors wind and current, and where is their data?	Medium	Please clarify the text to ensure it is clear when reference samples are being discussed. In addition, please expand the discussion of the selection of reference areas to discuss the answers to the above questions.	Text was modified to make clear that reference samples were being discussed. Wind data are collected by Teck Cominco at multiple locations around the mine and port site. Windroses showing several years of data at the mine and port are included in the Fugitive Dust Background Document (DEC et al. 2002). Current data were also discussed in the background document, originating from AGRA (2001). More recently, since the draft risk assessment (Exponent 2005) was published, the U.S. Army Corps of Engineers issued a Draft Environmental Impact Statement associated with a prospective port site expansion project (USACOE 2005), in which wind and current data are included. This new reference has now been added to the risk assessment text. *AGRA. 2001. DeLong Mountain Terminal Project: Onshore facilities feasibility study. Draft Report. Volume 1. Project No. A151H. AGRA Engineering Global Solutions.* *U.S. Army Corps of Engineers. 2005. Draft Environmental Impact Statement. Navigation Improvement Delong Mountain Terminal, Alaska.* *Available at: http://www.poa.usace.army.mil/en/cw/delong/deis.html. Last accessed: 8/17/2006.*	Response is acceptable.

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CSP2-30:	**3.3.3.1.2 Marine Environment** The risk assessment document states "For lead, there was insufficient statistical power to distinguish the mean site concentration from zero (and therefore insufficient power to distinguish it from the reference mean), because of the high variability in lead concentrations. Therefore, a statistical comparison with reference was not made for lead." (Page 317). The Washington State Sediment Standards also set allowable levels for other contaminants in marine sediments: Table I Marine Sediment Quality Standards—Chemical Criteria CHEMICAL PARAMETER MG/KG DRY WEIGHT (PARTS PER MILLION (PPM) DRY) ARSENIC 57 CADMIUM 5.1 CHROMIUM 260 COPPER 390 LEAD 450 MERCURY 0.41 SILVER 6.1 ZINC 410 Comparison of the maximum sediment concentrations presented in Table 3-12 of the risk assessment to the Washington state sediment standards (above) shows that cadmium and zinc also exceed standards. Based on the elevated concentrations of lead, cadmium and zinc in the marine sediments these contaminants should all be retained as COPCs in the risk assessment.	Medium	Please provide response regarding the final COPC list for the marine environment and how it was arrived at, including a clear description of the screening benchmarks used and why they were selected.	Please refer to response to comment CSP2-4 for a discussion of the revisions and clarifications made to this text section. Section 3.5.4.1, describes the three sets of ecological screening benchmarks that the marine sediment concentrations were compared with, including effects range-low (ERL) and effects range-medium (ERM) guideline values developed by Long et al. (1995) for marine sediment, and the Washington State marine SQS (WAC 173–204). (Table 3-26 shows the screening criteria that were used.) The CoPCs listed in this comment were not retained in the risk assessment because the most recent rounds of sampling yielded concentrations that were well below all of the screening criteria (see Sections 4.3 and 6.1.2.5, and Figures 4-14 through 4-25).	Response is acceptable.
CSP2-31:	**3.3.3.2.2 Marine Environment** Table 3-26 states: "The maximum zinc concentration in marine sediments (2,550 mg/kg), however, was still lower than the soil screening criteria for zinc of 4,100 mg/kg" (page 3-18). The Marine sediment quality standards presented in Table 3-26 show the zinc standard as 410 mg/kg, not 4100 mg/kg as referenced in the risk assessment. The marine sediment samples exceeded the marine sediment quality standard for zinc and thus should be retained as a COPC. There is no documentation of how many samples exceeded the real sediment quality standard of 410 mg/kg. The sentence "Thus, even with the higher direct contact assumed in the soil screening criteria, human exposure to the zinc concentrations in marine sediments would not pose a risk to	Medium	Please provide response regarding the apparent error in zinc screening values listed above and/or clarify the text to indicate when ecological versus human-health risks are being discussed. Additionally, please provide a response regarding the final COPC list for the marine environment and how it was arrived at, including a clear description of the screening benchmarks used and why they were selected.	It is true that the marine sediment quality standard is 410 mg/kg, and as mentioned in the sentence in Section 3.3.3.2.2 preceding the sentence quoted in Comment CSP2-31, 3 of 136 zinc samples exceeded the marine sediment criteria. However, the subsequent sentence in that paragraph discusses the soil, as opposed to sediment, criteria of 4,100 mg/kg. This value is the residential screening soil toxicity value, and is discussed in Section 3.3.1.2, and is also described in Table 3-14. Therefore there was no error in the zinc screening values, and the text was clarified to further make the distinction between soil and sediment criteria being discussed. Furthermore, the CoPCs listed in this comment were not retained in the risk assessment because the most recent rounds of sampling events yielded concentrations that were well below all of the sediment screening criteria (see Sections 4.3 and 6.1.2.5, and Figures 4-14 through 4-25). Please refer to the response to Comment CSP2-30 for a description of the methodology used to derive the final CoPC list.	Response is acceptable.

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	human health" should be eliminated. By definition, if sediment standards are exceeded there are risks to the environment and public health. Lead values in the sediment exceeded the Marine sediment quality standards of 450 mg/kg by an order of magnitude. By definition they cause risks to the environment and public health. These risks must be evaluated within a revised risk assessment.				
CSP2-32:	**3.3.3.3 Selection of Human Health CoPCs for the Lagoon and Marine Environments** The conclusion drawn in this section are in error for the reasons stated above. Risk to the marine environment from lead, cadmium and zinc must be evaluated	Medium	Please correct the text accordingly for any errors made.	As described in Section 3.3.3.3, no water or sediment concentration criteria were exceeded. As stated in the text, sediment concentrations from the most recent sampling events did not exceed any of the three sets of sediment criteria used for determination of CoPCs. Please see above comments CSP2-30 and CSP2-31.	Response is acceptable.
CSP2-33:	**3.5.2.2 Stream surface water** AWQC which are hardness dependent should be listed, with their respective adjustments, in a table cited here in the text.	Low	Please include the requested table.	This information was presented in Table 3-21. Text was updated to refer reader to the table.	Response is acceptable.
CSP2-34:	**3.5.4.1 Lagoon sediment** discusses guidelines used by the State of Washington as having been used in Alaska, as well. However, they were only determined to apply to Alaska by Exponent in a 1999 study in Ward Cove, for the Ketchikan Pulp Company. There may or not be good reason to allow these guidelines to apply to ecosystems as different as southeast (which is more similar to Washington) and northwest Alaska.	Medium	Please provide an explanation of the applicability of the State of Washington criteria in northwest Alaska.	The Washington State marine SQS are applicable to and protective of the benthic macroinvertebrates in the Alaskan marine environment, including the taxa found in the area of the DMTS port facility. Benthic macroinvertebrate communities in Puget Sound and Alaska have similar taxonomic compositions. The taxa found in Puget Sound, and represented in Ecology's database that was used to derive the SQS (Ecology 2003), include essentially all of those found at the DeLong Mountain Terminal in summer 2000 (RWJ 2001). Taxa found at DeLong but not found in Puget Sound account for only about 0.25 percent of the total number of individuals at the DeLong Mountain Terminal. To develop the criteria, various species and life stages were tested; the SQS for a chemical is defined as the lowest level indicated by any of the biological tests; the data are representative of a wide variety of hydrogeographic conditions and potential contaminants, and these data include taxa typically found in Alaska; and the criteria selection includes steps to objectively identify biological effects and to assess the predictive reliability of candidate SQS. Nevertheless, as mentioned in Section 3.5.4.1, three sets of screening criteria were used, including 1) the ERL guideline values developed by Long et al. (1995) for marine sediment; 2) the ERM guideline values developed by Long et al. (1995) for marine sediment; and 3) the Washington State marine SQS (WAC 173–204). The lowest of these three screening criteria was used for screening purposes, and therefore the screening was based on the most conservative of the three criteria. *Ecology. 2003. Sediment quality information system. Available at: www.ecy.wa.gov/programs/tcp/smu/sedqualfirst.htm. Last revised June 9, 2003. Washington State Department of Ecology, Toxics Cleanup Program.* *RWJ. 2001. DeLong Mountain Terminal 2000 Environmental Studies. Final Report. RWJ Consulting. March 2001.*	Response is acceptable.
CSP2-35:	**3.5.6 Wildlife** mentions that water ingestion is not included in the exposure analysis, because chemical concentrations in water were shown to be low and would therefore not have an effect on the results of the analysis. This is not necessarily true, because 1) water sampling may have been	Medium	Please provide response regarding the importance of the drinking water pathway to total exposure. If not already included in the RA report, one or more examples should be prepared to illustrate the relative importance of this pathway. Additionally, please provide response to the criticism that older references are used as sources of wildlife TRVs.	Water ingestion was not used for screening purposes, but was included in the risk assessment exposure analysis (please refer to Section 6.5.1). Water ingestion rates were derived using drinking water ingestion equations for birds and mammals from U.S. EPA (1993). Additionally, water ingestion is a negligible input compared to sediment or soil and food ingestion, contributing less than 1% to the total daily intake for the receptor that drinks the largest amount of water relative to its body weight, the	Response is acceptable.

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	conducted in such a way that results don't indicate the true chemical concentrations of the water ingested by wildlife, and 2) the consumption, over time, of even slightly contaminated water could have some cumulative effect on animals' health. Cites **table 3-28**, which presents TRVs, each with a citations. Citations indicate TRVs determined in years ranging from 1946 to 1994, with only two more recent than 1990.			Lapland Longspur. Therefore, because water ingestion is a minor component of daily ingestion, any uncertainty associated with water data is not likely to affect risk conclusions. Availability of toxicity data and suitability for use at a given site vary on a case-by-case basis. The selection of TRVs used in this assessment was based on an evaluation of the technical quality and ecological relevance of the study from which the values were taken. Modeled exposures were compared directly with the best available NOAEL and LOAEL TRVs derived from the literature, as outlined in the effects characterization (Section 6.5.2). Regarding TRV selection, multiple studies were reviewed, but only the studies with the most relevant data (appropriate receptor species and appropriate endpoint) were utilized for TRV derivation. TRV studies were selected based on relevance, not year published. As described in Section 6.5.2, availability of toxicity data and suitability for use at a given site vary on a case-by-case basis.	
CSP2-36:	**3.5.6.2 Piscivorous wildlife** ■ where was data available for fish? When and where was that data collected? How old were the fish tested? ■ discussion of sampling conducted in 2004 leads the reader to believe that sampling in DMTS creeks was conducted along with sampling in Greens Creek; this should be rephrased, and the data used in this risk assessment cited. ■ thus, because of the uncertainty caused by uncited fish data, the statement that 'further evaluation of risk to piscivorous wildlife foraging in freshwater streams and creeks is not required' should be reconsidered.	Medium	Please provide more specific information about when and where fish samples were collected and the specifics about the fish collected. If this information is provide in another report, summarize the information in this report and refer to other report. This should be done in the review of existing studies. Please clarify what data was used in the RA.	The source of the data is Morris and Ott (2001). Tables in Appendix C have been footnoted with the data sources. The data are tabulated in Appendix C. Further discussion is provided in Section 6.3.4. The citation was added to the text in Section 3.5.6.2.	Response is acceptable.
CSP2-37:	**3.6.1.2 Second tier media screening** compares concentrations to those in reference areas. The rationale for this comparison is sound, but the reference areas to which concentrations are compared are not.	High	Duplicate of comment on reference areas.	Please see comment response for CSP2-9 for discussion of reference area selection. The second to last sentence in Section 3.6.1.2 was revised to refer the reader to the discussion of reference areas in the document: *The results of this comparison are summarized in Table 3-37 (statistical comparisons of site and reference data are presented by medium and environment in Tables 3-5 to 3-13), and discussion of the reference area selection is provided in Section 6.6.*	Response is acceptable.
CSP2-38:	**3.7 Data gaps** states that there were sufficient data to complete the CoPC screening, citing the three or more analyses for every analyte, in every medium, both for site and reference conditions. However, three analyses per analyte standing as a reference, or four, eight, or nine analyses per analyte per site, does not provide enough data to reach a definite conclusion.	High	Please provide additional rationale about the sufficiency of the coverage of the sampling. Please acknowledge that it would not be possible to make a definite conclusion, but sufficient samples could be collected to be scientifically defensible and be representative of site conditions.	Sample results were generally consistent with the patterns and gradients of concentrations known from prior sampling work. Also, despite concerns about reference-based screening, 15 of the 22 CoPCs evaluated were retained for further evaluation in the baseline risk assessment, so the likelihood that CoPCs were incorrectly screened out on the basis of comparison to reference values is minimal. Had additional resources been devoted to data collection, the findings of the risk assessment would likely be unchanged. The samples collected were intended to be representative of site conditions, and scientifically defensible. A discussion of uncertainties associated with sample size has been added as Section 6.6.2 in the document. The new text for Section 6.6.2 is provided below: ***Uncertainties Related to Sample Size*** *The knowledge of depositional patterns gained from collection of data in multiple media results in a fairly clear picture of depositional patterns as associated with site sources. This conceptual model lends itself to interpreting smaller data sets within a given medium, whereas in the absence of the broader conceptual model, these*	Response is acceptable.

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				smaller data sets may be of less value. The small sample sizes are the result of balancing resources and available time to collect data for the risk assessment, limited to two short field seasons. The risk assessment provides an understanding of what the potential risks are, thereby helping to focus additional information gathering on receptors and/or media where these potential risks were identified. Thus, the limitations of the small sample sizes can be further addressed, as needed, in future monitoring focused on areas of potential risk identified as part of this assessment. Risk assessment generally does not provide a "definite conclusion," but rather identifies the likely presence or absence of potential risks, thereby providing the information necessary for future risk management decisions and actions. The possible need for additional data collection to address areas of uncertainty (e.g., through future monitoring) will be considered during development of the risk management plan.	
CSP2-39:	The fate of all of the tundra ponds affected by the DMTS and by Red Dog should not be decided based on *three* samplings, particularly when the numbers vary greatly. For example, four tundra pond sediment samples' lead content varied from 8.96 mg/kg dw to 2,180 mg/kg dw (table C-9).	Medium	Please provide additional rationale as to why the number of samples collected is (or is not) sufficient to be representative of tundra ponds.	The concentrations of samples in pond media are consistent with those in other media, such as moss, given the understanding of patterns of deposition, and varying proximity to site sources. Samples collected from the four tundra ponds were spread out at varying distances between the mine and the port site (i.e., near the mine, middle of the road, and toward the port). In addition, two of the four site tundra ponds were sampled during both the Phase I and Phase II sampling events. Those two ponds were located within the port facility boundary, and the other two ponds were located on the downwind (north/west) side of the road. Given the limited availability of tundra ponds at the site, the number of samples collected is sufficient to be representative of tundra ponds located at the site. However, despite the limited number of available tundra ponds, the sample results from those ponds were consistent with the patterns of concentrations observed in samples collected in terrestrial media, i.e., concentrations higher near road and facility areas, decreasing with distance away from these areas.	Response is acceptable.
CSP2-40:	**4.2.2 Freshwater aquatic assessment** states that samples were taken from invertebrate tissue; where does lead collect in small animals? Should these samples have been taken from other parts of them?	Low	Please expand on the explanation of samples collected and terminology used to describe them. Does "invertebrate tissue" refer to whole-body, composite invertebrate samples? Please clarify the text accordingly.	Chemical analyses on invertebrates were conducted on whole body tissues. The text was clarified.	Response is acceptable.
CSP2-41:	**4.2.3 Costal lagoon assessment** says that fish sampling was "attempted." Details should be offered here, in particular following up on the statement made at a meeting in Kivalina (20 April 2005) that lagoon (s?) were seined for fish, and none were found. What time of year were the lagoons checked? How many times? Do subsistence users gather fish from lagoons? Have they been asked?	Low	Please expand on the explanation of samples collected. Please provide the information requested.	Fish were to be collected from the coastal lagoons during the Phase II June/July 2004 Sampling event. After thoroughly seining each of the three coastal lagoons from one to the other, field staff determined that there were no fish present in the coastal lagoons. In addition, no fish were visually observed by the sampling team during collection of other media at the coastal lagoons. Fish sampling was attempted, but no fish were found, and therefore no fish were collected from coastal lagoons during the Phase II sampling event (further discussion is provided in Appendix E).	Response is acceptable.
CSP2-42:	**4.3 Marine assessment and CoPC screening** mentions a prevailing northward current; this statement should be cited rather than saying "any field modifications" are discussed in Appendix E, those modifications should be detailed here, as they could have a large impact on the outcome of the sampling	High	Please add a new section that summarizes the field modifications.	Please see response to comment CSP2-29 for discussion of information sources for currents. Citations have been added to the text. Appendix E provides the following discussion: The following field modifications were made to the Phase II sampling strategy for the June 2004 marine assessment outlined in Exponent (2004a): • A modified Ponar grab sampler was used to collect the sediment samples rather than the stainless-steel Ekman grab sampler, modified petite-Ponar grab sampler, or a DRCV corer suggested in Exponent (2004a). The modified Ponar grab sampler provides the same quality of sediment sample, but the grab sampler is	Response is acceptable.

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				• slightly larger than the petite version and therefore provides more sediment per grab. • The location of Station NM-REF-1 was adjusted slightly to match the station coordinates sampled during the 2003 and June 2004 sampling events. Station NMREF-1 was placed as close as possible to the beach and the previously sampled station coordinates. The quality and usability of the data generated from this field event were not affected by these modifications, nor do the modifications have a large impact on the outcome of the sampling. However, this text was added to Section 4.3 as requested.	
CSP2-43:	**5 Human health risk assessment** states that "standard procedures developed by EPA and DEC, adapted, when appropriate, to the specific conditions of the site" What does this mean? When and where were these procedures adapted? Are all of these adaptations noted?	High	Please provide a list of the deviations from the EPA and DEC guidelines and an explanation for the deviations.	The adaptations to which this section refers are the use of site-specific data, not deviations from standard procedures. All site-specific inputs, and the basis for those inputs, are clearly described in the risk assessment in Section 5.2.2 when they are introduced. For example, Section 5.2.2.1.2 describes the use of a site-specific lead bioavailability factor that was used in addition to the default value, and the basis for the site-specific factor. Section 5.2.2.2.3 describes derivation of the site-specific subsistence food consumption rates. Because of the complex nature of this multi-pathway subsistence use risk assessment, there are necessarily many site-specific adaptations because standard formulas alone do not describe the types of exposure that would occur.	Response is acceptable.
CSP2-44:	**5.2.1.1 Exposure point concentrations for environmental media** assumes that site soil concentrations are representative of conditions 5 km downwind (north) of the DMTS and ambient air boundaries, and 2 km upwind (south). It has been stated that concentrations of cadmium in moss are unaffected by mining-related deposition beyond 3 km to the south and 12 km to the north of the DMTS within CAKR. Data also suggests that mining-related lead deposition extends at least as far north as the Iyikrok hills, 25 km north of the DMTS (NPS 2004 32). Thus discussion of a 7 km swath as being represented by samples taken from near the road may be appropriate given the limited data considered in this section; however, NPS 2004 suggests that there is a strong correlation between distance from the road and concentration of lead, cadmium, zinc, and aluminum. These findings should be considered in this section, and in the refined conceptual site model as a whole, because they present a far greater range of sampling locations then do the Phase I samplings.	High	Please respond to comment and include rationale for the justification for stating that the aforementioned samples are representative of the larger area.	Additional discussion of the Hasselbach data has been added in Section 1 (please refer to comment response CSP2-9 for the revisions to Section 1) describing nature and extent of fugitive dust deposition, and in Section 5 discussing the implications of the moss data on assumptions about exposure concentrations over the site area for the HHRA. In addition, at the request of DEC, in the revised HHRA risks were also calculated using an alternative caribou fractional intake of 0.2. This value was calculated using the area reported to have cadmium levels elevated above background by Hasselbach et al. (2005) as the site harvest area. Metals concentrations do decrease significantly within 1 km from the DMTS. Thus, use of road and port facility area soil concentrations is not representative of concentrations within the 7 km band along the DMTS used in the HHRA to represent the site. Road and port soil concentrations, in fact, represent an extreme overestimate of soil concentrations over the entire site area. Thus, as noted in Section 5.2.1.1 of the HHRA, the assumption that these soil concentrations are representative of conditions as far as 5 km downwind and 2 km upwind of the DMTS road and ambient air boundaries is conservative (i.e., protective).	Response is acceptable.
CSP2-45:	**5.2.1.2.1 Data used to calculate fish EPCs** states that all data comes from fillets of adult dolly varden collected. Subsistence users often consume the entire fish in some way, usually by boiling it into soup. If metals, particularly lead (which tends to reside in bone marrow), are contained in other parts of the fish besides its tissue, they wouldn't be considered in this risk assessment, but would be an added exposure pathway. Juvenile fish should also be sampled. While they may not be a primary exposure pathway at time of	Medium	Please provide a rationale for the use of fillets and include in the uncertainty section a discussion of the limitations of using fillets exclusively with respect to subsistence users.	The following additional text was added to Section 5.4.3.3.4 of the HHRA (the Uncertainty Assessment) to address this comment: *Lead concentrations in fillets from adult Dolly Varden collected by the Alaska Department of Fish and Game from the Wulik River from 1991 through 2003 were used in the risk assessment to estimate the fish lead EPC. Other fish organs may also be consumed, but tissue-weighted concentrations were not calculated for fish as they were for caribou and ptarmigan (described in Section 5.2.1.2.7). Although muscle tissue comprises most of the edible portion of the fish, portions of the fish not included could contribute to lead exposure. Of particular interest would be bone, where lead may accumulate. There is uncertainty regarding the concentrations of lead in fish bones, the amount of bone consumed by people, and the associated*	Response is acceptable.

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	sampling, data could be used to examine growth and metal accumulation trends in different parts of a particular species.			*contribution to estimated risks. This uncertainty is partly addressed by the fact that subsistence dietary lead is included in the integrated exposure uptake/biokinetic (IEUBK) child lead model in addition to the default dietary lead intake included in the model. Even with this overestimate of total dietary lead, predicted risks were very low. Inclusion of other portions of the fish would be expected to have little to no impact on the risk estimates because 1) tissues other than muscle comprise a relatively small percentage of total fish consumption, 2) lead concentrations do not differ significantly between whole body fish (which includes bones) and muscle or other tissues (e.g., liver and kidney) of Dolly Varden collected in the Wulik by the ADFG (Scannell 2005), and 3) intake of lead from fish is less than 4 percent of total estimated dietary lead intake (Table 5-8).* As an additional note, while bone is a storage site for lead, bone marrow is not. Thus, it is important to discuss the two tissues separately. See response to Comment CSP2-46 for details. Mature fish tissue concentrations were used for the HHRA because they represent the food consumed by people in the area. And if there is a concern that metals will accumulate in fish, larger adult fish are the best choice to evaluate that possibility. Concentration trends in fish will be followed over time through the ongoing fish monitoring program. While it is unnecessary to evaluate metals concentrations in juvenile fish for the purpose of monitoring potential human health risks, it is important from the perspective of monitoring fish health. As such, Alaska Department of Fish and Game (ADFG) does monitor metals concentrations in juvenile fish as well as other ecological parameters that are indicative of the health of the fish populations in the area.	
CSP2-46:	**5.2.1.2.2 Data used to calculate caribou EPCs** states that all data comes from tissue; all parts of the animal which are consumed by subsistence users should be considered. Notes from a community meeting in Kivalina (20 April 2005) indicate that subsistence users do consume, among other things, caribou bone marrow. Evidence should be given detailing how and where each CoPC interacts with a caribou.	Medium	Please respond to issues raised by comment.	The data used for the risk assessment were from caribou harvested after over-wintering near the DMTS. Thus, they were harvested during a period of time when any metals exposure related to site would have still been reflected in their soft tissue sample concentrations. Even so, comparison to caribou from elsewhere in Alaska and other areas of the world indicated that metals concentrations were not elevated in site caribou. Nevertheless, despite evidence that caribou metals concentrations were similar to background, those concentrations were conservatively treated as if they were entirely site-related in the risk estimates. Furthermore, given the temporal juxtaposition of site exposure and tissue sampling, there is little reason to believe that bone lead levels would be elevated relative to background when tissue lead levels are not elevated relative to background. A discussion of uncertainties related to lack of data on bone and bone marrow lead has been added to the risk assessment. It should be clarified that bone and bone marrow are two different tissues. When discussing “bone” in this context, it is the mineralized (hard) portion of the bone. Bone marrow is part of the lymphopoietic system (lymphatics, blood, and blood forming tissue) and is related to bone only in its location in the body and in that it shares a name. While bone is a storage site for lead, bone marrow is not. Thus it is important to discuss the two tissues separately. Bone marrow is the more likely of the two tissues to be consumed. Bone marrow would not be expected to be preferentially enriched in lead relative to the organs sampled. In fact, because caribou bone marrow is more than 95 percent fat (http://www.nutritiondata.com /factsB00001-01c226S.html), it is not a good source of minerals in general, and would be less likely to store the metals being evaluated at the site than the muscle and organ tissues that were sampled.	Response is acceptable.

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				In addition, bone marrow would make up an exceedingly small portion of the caribou tissue consumed by humans relative to muscle. Thus, because it is not a storage site and is a relatively small part of dietary intake, inclusion of bone marrow would have little or no impact on the results of the risk assessment. Bone is a storage site for lead, and would be more likely to reflect very long-term exposure than soft tissues such as liver, muscle, and kidney. However, as with bone marrow, if bone consumption were included in the risk assessment, it would have little impact on overall risk results because bone would comprise a very small portion of the overall amount of caribou consumed by people, compared with muscle tissue. In addition, it's important to remember that the caribou metals concentrations used in the risk assessment come from caribou that over-wintered at the site. If site metals do affect metals concentrations in caribou, it would be reflected in the recent "exposure" experienced by these over-wintering caribou, and highly vascularized soft tissues such as liver should reflect that exposure.	
CSP2-47:	**5.2.1.2.3 Data used to calculate ptarmigan EPCs** states that all data comes from tissue; all parts of the bird which are consumed by subsistence users should be considered. Evidence should be given detailing how and where each CoPC interacts with a ptarmigan. Reference ptarmigan are mentioned, but the location of the reference site is not cited. Where is it? Were the reference ptarmigan far enough from the mine and port sites to be unarguably free of mine-related contaminants?	Medium	a) Provide information on which parts of the ptarmigan were analyzed. Please either point to the location or provide a discussion on how birds metabolize metals. b) Provide information requested about the locations where ptarmigan were collected.	The contribution from ptarmigan of metals to the subsistence diet was estimated using weighted contributions from muscle, kidney, and liver tissue. It is possible that people could eat other portions of the animal. Although the tissues included in the analysis comprise most of the edible portion of the animal, portions of the ptarmigan not included could contribute to metals exposure. Of particular interest would be bone, where lead may accumulate. There is, thus, uncertainty regarding the concentrations of lead in ptarmigan bones, the amount of bone consumed by people, and the associated contribution to estimated risks. This uncertainty is partly addressed by the fact that subsistence dietary lead is included in the IEUBK child lead model in addition to the default dietary lead intake included in the model. Even with this overestimate of total dietary lead, predicted risks were very low. The uncertainty is further mitigated by the fact that ptarmigan comprise a very small part of the subsistence diet. For cadmium, the CoPC contributing most to the ptarmigan hazard index, the kidney, which was included in the analysis, is the organ where it is most likely to accumulate. Site and reference ptarmigan sampling locations are shown on Figure 4.1. Please see response to comment CSP2-9 for discussion of reference area selection and suitability. Detailed discussion of the ptarmigan sampling and analysis, and a comparison between site and reference ptarmigan is provided in Appendix H. Metals concentrations were analyzed in both site and reference ptarmigan. However, as with caribou, site ptarmigan metals concentrations were conservatively treated as if concentrations were entirely site related in the risk estimates. Monitoring of ptarmigan will be considered during development of the risk management plan.	Response is acceptable.
CSP2-48:	**5.2.1.2.6.1 Fish** Lead and thallium may undergo different reactions/processes both before and after they are incorporated into a fish. Because of this, it is impossible to "estimate" an EPC for thallium in a fish's tissue by examining the relationship between the two elements in the fish's environment. The RA states that "the mean thallium concentration in surface water was divided by the mean lead concentration in surface water." This is not an appropriate determination of thallium in a fish's tissue. Furthermore, it has been shown that fish exposed to food-borne metals were more susceptible to toxicity than fish exposed to water-borne metals (Peplow 2005). Taking this into	Medium	Please provide response regarding the scientific validity of the approach used and possible uncertainties in the risk estimates created by it.	Because data on thallium in fish were not available, it was agreed upon with DEC in the response to the RAWP comments that thallium could be estimated in fish based on the relationship between thallium and lead concentrations in surface water. This assumes uptake and bioaccumulation of both compounds occurs at the same rate. Additional supporting information has been added to Section 5.2.1.2.6.1, and the uncertainties associated with this method are described in Section 5.4. In response to this comment, the following paragraph was added to the end of Section 5.2.1.2.6.1: *This approach assumes that uptake of thallium in fish from water occurs at approximately the same rate as lead uptake. This assumption may over- or underestimate actual fish thallium concentrations. To evaluate this assumption, published bioconcentration factors (BCFs) for thallium and lead were compared. A BCF represents the relationship between the water concentration of a chemical and the fish tissue concentration of the chemical. The method used in this risk*	Response is acceptable.

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	consideration, EPCs should have been derived using concentrations of metals in sediment, rather than surface water, to continue in keeping with the RA's conservancy.			*assessment assumes that the BCFs for lead and thallium are approximately the same. ATSDR (1999a) reports a median BCF value for lead in fish of 42. For thallium, ATSDR (1992c) reported a maximum BCF for bluegill of 34. Because these BCFs are similar, it is considered reasonable to use the ratio of thallium to lead in water to predict thallium concentrations in fish.* Also, the following revisions were made to Section 5.4.3.5: *The lack of analytical data for some CoPCs in fish (thallium) and caribou (antimony, barium, and thallium) adds a level of uncertainty into the risk assessment. Rather than proceed without quantitative estimates of risk from these CoPCs, available data from other media were used to estimate concentrations of these CoPCs in fish and caribou.* For fish, the relationship between thallium and lead in water was used to estimate thallium concentrations in fish. This assumes that uptake of thallium in fish occurs at approximately the same rate as lead uptake. This assumption may over- or underestimate actual fish thallium concentrations. To evaluate this assumption, we compared published BCFs for thallium and lead, as described in Section 5.2.1.2.6. Because the BCFs were similar, uptake was assumed to be similar. Depending on the study design and fish species used, BCFs calculated for a given chemical may vary by one or more orders of magnitude. But given the low predicted thallium risk estimates from fish consumption (0.001 for adults and 0.05 for children), this comparison suggests that use of the relative concentrations of thallium and lead in water to predict fish tissue thallium concentrations is reasonable. Regarding use of sediment data to estimate thallium concentrations, the surface water approach used in the HHRA provides a more conservative approach. As noted in Table 3-6, the mean stream sediment concentrations of site thallium and lead were 0.1 and 31.7 mg/kg, respectively. The thallium to lead ratio that would be derived using sediment would be 0.003, which is less than the ratio of 0.17 predicted by surface water. Thus, use of sediment data would predict a lower fish thallium concentration.	
CSP2-49:	**5.2.1.2.6.2 Caribou** states that muscle tissue stands as 90% of the "food mass." Where does this figure come from? Similarly to fish, different chemicals are taken up at different rates and metabolized through different pathways, depending on their states or what compounds they may start out as a part of. A comparison, or ratio, of one element to another is not an appropriate measurement of toxicity, or an appropriate indicator of the amount of contamination an animal will undergo.	Medium	Please provide reference with respect to "food mass." Please provide the toxicological rationale for the use of ratios of chemicals.	ADPH (2001) and Stimmelmayr (1994) are cited as the protocol used to support the statement in Section 5.2.1.2.7 that "muscle tissue contributes the remaining 96%" of caribou edible tissue, and the following sentence was added: *The value of 2% for caribou liver and kidney was estimated based on the percent weight of reindeer liver reported by Stimmelmayr (1994) and ADPH (2001).* The approach used to estimate caribou barium assumes that the ratio of barium to other metals in ptarmigan will be similar to or greater than the ratio of barium to those metals in caribou. This assumption may under- or overestimate the actual barium concentration in caribou. There is a large degree of uncertainty in this method because the differences in metals uptake and metabolism between these animals, and because the ratios of barium to cadmium, lead, and zinc spanned over two orders of magnitude. To address this uncertainty, the ratio that provided the most conservative (i.e., the highest) estimate of caribou barium concentration was used for each tissue.	Response is acceptable.
CSP2-50:	**5.2.2.1 Lead exposure** see discussion of section **5.3 5.2.2.1.2 Gastrointestinal absorption of soil lead** discusses the bioavailability of lead in Red Dog ore. However, it fails to consider the different	Medium	Duplicate of previous comments on speciation and bioavailability. Please develop a single response to this type of comment and refer to it.	The risk assessment evaluates lead risks based on both the EPA default bioavailabilities (30 percent for children, 12 percent for adults) and the site-specific bioavailability for Red Dog ore. The default bioavailability, which is far above the range for Red Dog ore, provides the conservative estimate of risk. The site-specific bioavailability provides a more realistic estimate, so it is appropriate to use the best	Response is acceptable.

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	conditions fugitive dust might undergo in the greater environment, some of which might increase bioavailability. According to Peplow (2005), mineral speciation, solubility of oxidized metals, and solubility products can be predicted using Eh-pH stability diagrams. A failure to examine mineral speciation is a failure to properly assess risk to the environment.			estimate for Red Dog ore, which is the average. Also, as summarized in Table 5-7 of the risk assessment, bioavailability of Red Dog ore lead decreased with increasing lead concentrations. Site soil lead concentrations are closest to the highest concentration used in the NTP study of 100 mg/kg, which was associated with an absolute bioavailability of 2.7 percent for children. Thus, the trend in results from the NTP study suggests that even the average bioavailability from that study may overestimate actual bioavailability. In fact, based on the data from the NTP study, both the average value and the lowest value would be conservative because most soil lead concentrations at the site are higher than those used in the NTP study. Calculation of risks using two separate bioavailability values is meant to provide a conservative bracket around the potential risks associated with the site. As discussed above, the trend in the NTP study was for bioavailability to decrease as lead concentrations increase. Because site soil lead concentrations are at and above the highest lead concentration used in the NTP study, it follows that soil lead bioavailability would more likely be represented by the lowest absolute bioavailability value from the study (2.7 percent), or lower. Thus, use of the average absolute bioavailability value from the NTP study of 3.9 percent is a conservative value to provide the lower end of the bracket of potential risks associated with the site. The EPA default value provides a very conservative estimate of potential risks at the upper end of the bracket. Use of a value anywhere in the middle of the two values used would not provide particularly useful information for risk managers, particularly a value such as 5.4 percent that has little relevance to site conditions. As discussed in response to DEC comment HH-21, uncertainties associated with use of results from the NTP study have been added to the revised risk assessment both in Section 5.2.2.1.2 and in the Uncertainty Assessment (Section 5.4.3). The following text has been added to Section 5.2.2.1.2 of the risk assessment: *There are two areas of uncertainty associated with the use of the NTP study results in the risk assessment. First, the NTP bioavailability study was conducted on Red Dog ore. After weathering, the lead in site soils may become more or less bioavailable. It should be noted, however, that many of the geochemical forms of lead that would most likely be formed from oxidation of lead sulfide in the environment (e.g., lead sulfites, lead sulfates, and lead oxides) are also considered by U.S. EPA (1999b) to have less than default bioavailability. Second, the NTP study used rats, whereas juvenile swine are the preferred animal model for development of site-specific bioavailability values (U.S. EPA 1999b). These issues are further discussed in the uncertainty assessment (Section 5.4.3), and addressed in the DMTS risk assessment evaluating risks using both the IEUBK model default absolute bioavailability of 30 percent and the site-specific value of 9.7 percent.* In addition, further discussion was added to the uncertainty assessment (Section 5.4.3).	
CSP2-51:	**5.2.2.2.3 Subsistence food** again uses a strip 5 km downwind and 2 km upwind of the DMTS and mine ambient air boundary, which should not be representative of the whole of the site; see discussion of section **5.2.1.1** Should cite data that shows the extension of caribous' and fishes' home ranges beyond the	Medium	Please provide a map or describe home ranges of the species evaluated.	For large home range subsistence foods (i.e., caribou and fish), the metals concentrations in those animals already integrate the animal's exposure over their entire home range; therefore, the fractional intake (FI) represents the fraction of the total metals concentrations in those animals that is attributed to the site. As with the plant foods and ptarmigan, it is based on the area of the site relative to the total area of subsistence harvest. In fact, the home ranges for both caribou and fish are far larger than the subsistence harvest areas for Kivalina or Noatak. Thus, the FI likely greatly overestimates the fraction of metals in these animals that is attributable to the	Response is acceptable.

No.	Comment	Priority	Recommendation	Response	DEC Remarks
	subsistence areas. Which anadromous fish confine themselves to a single watershed? For those that do not (dolly varden), where do they go? Where do young fish and caribou do their growing? Animals would be most susceptible to toxic effects during this time.			site. In addition, the results of the caribou metals evaluation (Appendix H) suggest that metals concentrations in caribou harvested at the site are not elevated relative to background. If that were indeed the case, any risk estimate based on caribou metals concentrations, regardless of the FI applied, would be an overestimate of site-related risks. Additional text has been added to Section 5.4.3.7 of the HHRA to further address the uncertainties discussed above regarding fractional intake. In addition, at the request of DEC, risks were also calculated using an alternative caribou FI of 0.2. This value was calculated using the area reported to have cadmium levels elevated above background by Hasselbach et al. (2005) as the site harvest area. In response to this comment, the following revisions were made to Section 5.4.3.7 (Fractional Intake): *The fractional intake from the site is an area of uncertainty. Fractional intake is intended to account for the fraction of total media exposure (soil, water, berries, sourdock, and ptarmigan) that occurs at the site.* *For stationary subsistence foods (i.e., berry and sourdock) and foods with a small home range (i.e., ptarmigan) the FI represents the fraction of that food type collected from the site relative to all areas where it is collected. It is true that harvesting can only occur where the food item is available, and not evenly throughout the subsistence harvest area. However, in the absence of data to the contrary, it is a reasonable assumption that a person would be equally likely to harvest a given food on a similarly sized area off the site and on the site. As an example, berries do not grow evenly throughout the site. However, the proportion of the "site" harvest area covered by berries can reasonably be assumed to be similar to the proportion of the non-site harvest area covered by berries. And if a person is equally likely to harvest from each of the berry harvesting areas, an FI based just on berry harvesting areas would be the same as the FI that was calculated based on the entire harvest use area. And a person may, in fact, be more likely to use a berry harvesting area nearer to home, which would be off-site, than one on-site that is further away (and off-limits). Thus, it is reasonably likely that the FI, as calculated, overestimates fractional intake from the site.* *For subsistence food animals with large home ranges (caribou and fish), FI is intended to account for the fraction of the animal's life that is spent at the site, and thus the fraction of metal content in the animal that is theoretically attributable to the site. As with the plant foods and ptarmigan, it is based on the area of the site relative to the total area of subsistence harvest. For caribou and fish, the metals concentrations in those animals used in the risk assessment already integrate the animal's exposure over their entire home range. But only a fraction of the metals detected in these animals would have been derived from site exposure. Given that there appears to be no significant difference in metals concentrations in site caribou relative to caribou from elsewhere in Alaska (Appendix H), it can be inferred that site caribou do not appear to have been exposed to greater amounts of metals at the site than elsewhere in their home range. Thus, the fraction of metals detected in those caribou that could be attributed to site exposure can be estimated by the fraction of time spent at the site relative to elsewhere in their home range, which can in turn be estimated by the fraction of the area of the site relative to their entire home range. In fact, the home ranges for both caribou and fish are far larger than the subsistence harvest areas for Kivalina or Noatak. Thus, the FI used in the risk assessment likely greatly overestimates the fraction of metals in these animals that is attributable to the*	

No.	Comment	Priority	Recommendation	Response	DEC Remarks
				site. In addition, as noted above and detailed in Appendix H, the results of the caribou metals evaluation suggest that metals concentrations in caribou harvested at the site are not elevated relative to background. If that were indeed the case, any risk estimate based on caribou metals concentrations, regardless of the FI applied, would be an overestimate of site-related risks. *While it is difficult to quantify the exact fractional intake, it can be estimated using knowledge of use patterns. For the DMTS risk assessment, three primary sources of information were used to estimate fractional intake: 1) Previously published information on the extent of subsistence use areas for Kivalina and for Noatak (Dames & Moore 1983a,b); 2) Knowledge of the nature and extent of metals concentrations around the DMTS; and 3) Information about standard work schedules at the Red Dog mine.* *The estimated fractional intakes used in the risk assessment (0.09 in the subsistence use scenarios; 0.67 and 0.03 (while off work) for soil ingestion and 0.045 for food/water consumption in the worker/subsistence use scenario) may over- or underestimate the actual fractional intake from the site. This issue is partly addressed by inclusion of risk estimates using an alternative caribou fractional intake of 0.2, as described in Section 5.2.2.2.3. To further address this uncertainty, the effect of altering the fractional intake on the estimated risks from exposure to non-lead metals was evaluated.* *For the child subsistence use scenario, a cumulative hazard index of 1.0 is estimated only when the assumed fractional intake is 0.36 (i.e., 36 percent of all soil, water, and food consumption was from the site). If a fractional intake of 1.0 is assumed (i.e., that 100 percent of all soil, water, and food consumption was from the site), the resulting cumulative hazard index is 2.9. While this hazard index exceeds the target of 1.0, it is still within the degree of uncertainty inherent in the RfDs used to calculate risks. In addition, risks from individual CoPCs are not typically considered cumulative and summed unless the target organ and mechanism of action on which the RfD is based are the same. Only two CoPCs (i.e., barium and cadmium) have RfDs based on effects in the same target organ (the kidney). In reality, the fractional intake from the site would never be 1.0 for a child, and the FI of 0.09 used in the risk assessment likely significantly overestimates an actual child's contact with the site.* *For both the adult subsistence use and the combined worker subsistence use scenarios, a cumulative hazard index of 1.0 was estimated only when the assumed fractional intake was 0.95 (i.e., 95 percent of all soil, water and food consumption was from the site). If a fractional intake of 1.0 is assumed, the resulting cumulative hazard index is 1.1. Again, this is within the degree of uncertainty inherent in RfD derivation, and no individual CoPC exposure would result in a cumulative hazard index exceeding 1.0, even with a fractional intake of 1.0. Although an adult may come into contact with the site to a greater degree than a child, an actual adult would still never attain 95 percent of their soil, water, and food from the site. Furthermore, site restrictions do not allow subsistence harvesting on the site at all.*	

No.	Comment	Priority	Recommendation	Response	DEC Remarks
				Effect of changing fractional intake on estimated risks for non-lead metals *Scenario* / *Cumulative HI Associated with: Site-Specific FIs* / *Cumulative HI Associated with: FI=1.0* / *FI Associated with Cumulative HI=1.0* *Child Subsistence Use* / *0.3* / *2.9* / *0.36* *Adult Subsistence Use* / *0.1* / *1.1* / *0.95* *Worker/Subsistence Use* / *0.08* / *1.1* / *0.95*	
CSP2-52:	**5.2.2.3 Review of existing subsistence food consumption rate** mentions that though dolly varden are anadromous, they are used to represent all of the fish in the Wulik watershed (or, streams in proximity to the DMTS). Salmon are not considered at all, because they are anadromous, and therefore 'spend very little time in freshwater near the DMTS.' First, if anadromous fish ought not to be considered because of their lifecycles, why are dolly varden used as representatives? Second, salmon (and all anadromous fish) spend their *formative* time in the Wulik watershed, where they would be exposed to contamination from fugitive dust. It is during this time that heavy metals, lead in particular, could be taken up into their bodies and, among other health effects, inhibit growth. For this reason, it is irresponsible to dismiss salmon as a species considered in this RA.	Medium	Please provide additional rationale on the selection of fish species evaluated.	In reality, Dolly Varden were included in the risk assessment in spite of the fact that they are anadromous and that most of their life cycle is spent offsite, and therefore most of their metal content is likely due to background sources. This provides a much more conservative estimate of risks associated with fish consumption than if only non-anadromous species and their associated low consumption rate were used. It is more protective to use a consumption rate that includes Dolly Varden and all other non-salmon fish. The subsistence foods database indicates that Dolly Varden make up the most substantial fish portion of the diet. Dolly Varden spend summers feeding in marine waters, then in fall enter the Wulik, Noatak, Kivalina, and other rivers, where they overwinter (but do not feed). While Dolly Varden do enter the streams crossing the DMTS (e.g., Anxiety Ridge Creek and Tutak Creek) to spawn, they spend very little time there, since the habitat is not suitable for overwintering. Instead, they migrate back out to the Wulik after spawning. Dolly Varden metals concentrations do not appear to differ significantly between fall (when the fish are returning from marine waters) and spring (after overwintering in the Wulik) sampling periods, suggesting a lack of impact from site-related freshwater metals concentrations that may be higher than background levels they would encounter elsewhere. Including salmon would be overly conservative since salmon spend even less time on site. The aim of a risk assessment is to use conservative, but reasonable, estimates of exposure related to the site to estimate risks. In conclusion, rather than lacking conservativeness by not including salmon, the approach should be considered conservative because it includes Dolly Varden, an anadromous species.	Response is acceptable.
CSP2-53:	**5.2.3.1.4 Gastrointestinal absorption fraction of lead from soil** see discussion of **5.2.2.1.2 5.3** **Toxicity assessment** explains that the CDC measures lead toxicity according to blood lead levels; it should discuss ■ "Only about 32% of the lead taken into the body of a child will leave in the waste. Under conditions of continued exposure, not all the lead that enters the body will be eliminated, and this may result in accumulation of lead in body tissues, notably bone" (ATSDR 1999) ■ "Increases in blood lead levels during infancy and childhood are associated with attention deficits, increased impulsiveness, reduced school performance, aggression, and delinquent behavior" (Schettler et al. 2001)	Medium	Similar to Peplow comment on exposure routes. Please address the concern in the last paragraph in the uncertainty section.	All information regarding lead toxicity and quantitative estimates of that toxicity that is relevant to the risk assessment is included in Section 5.3 of the HHRA. Lead is one of the most highly studied metals and there is a very large database on lead toxicity and exposure. Summaries of that information, as it relates to environmental exposures, can be accessed on the portion of the EPA website devoted to lead (http://www.epa.gov/superfund/programs/lead/). See responses to CSP2-13 and CSP2-14 regarding selection of exposure pathways. Cadmium is the only site CoPC for which EPA considers the scientific evidence adequate to derive a quantitative estimate of carcinogenicity by an exposure route other than those identified for the site. Specifically, EPA considers cadmium a carcinogen by the inhalation route. However, there are two reasons why this finding is not relevant to the risk estimates for the site. First, the study used by EPA to derive the inhalation cancer slope factor is based on inhalation exposure to high levels of metallic cadmium fumes in an occupational setting, not the low levels of soil-sorbed cadmium salts present at the site.	Response is acceptable.

No.	Comment	Priority	Recommendation	Response	DEC Remarks
	■ "These and other data suggest that there may be no threshold for the adverse consequences of lead exposure, and that lead-associated impairments may be both persistent and irreversible" (Canfield et al. 2003) ■ "In isolation, each of these studies demonstrates merely an association between lead levels and impaired mental development. However, the volume and consistency of the epidemiological evidence and the strength of the prospective, longitudinal study designs, in conjunction with evidence supporting the biologic plausibility of the neurotoxicity of lead, provides persuasive evidence that low-level lead exposure results in persistent impairment of learning and other complex cognitive tasks" (Sanborn et. al. 2002). States that "none of the site CoPCs is classified by EPA as a carcinogen for the exposure routes relevant to this assessment." Peplow (2005) explains that exposure routes, and their completeness, was decided arbitrarily in this RA, implying that some routes may exist that are only partly or are not considered. What if a CoPC acts as a carcinogen for an exposure route that has gone unconsidered?			Second, as shown in Table 2-3 of the DMTS risk assessment, even if one assumes that the effects from inhaled soil-sorbed cadmium are equivalent to those from cadmium fumes, an evaluation based on the non-cancer effects of cadmium ingestion is more conservative than one based on the carcinogenicity of inhaled cadmium. This is demonstrated by the fact that the EPA Region 9 preliminary remediation goal (PRG) for noncancer effects from ingested cadmium is nearly 40 times more conservative than the PRG for cancer from inhaled cadmium.	
CSP2-54:	**5.4.3.3 Discussion of ADPH blood lead surveys** should not be included. The conclusions drawn in the 2004 and 2005 reports are statistically unfounded: a sample size of ten in Kivalina (only two of them under the age of 18, and none under the age of 6) combined with data from Noatak (ADPH 2004), presumably to make a sample size more viable, is not statistically worthwhile, and any statement made or supported by such data is not made or supported by true science.	Medium	Please ensure that the weaknesses of the above mentioned reports are described when these reports are described in the RA.	The small sample size of ADPH (2005) does limit specific conclusions based on that study. However, the results of that study are consistent with results of the risk assessment that blood lead levels are not predicted to be elevated. Although the results of the ADPH surveys are presented and discussed in the uncertainty section, they do not enter into the risk assessment process. Rather, they are provided for comparison. Although there are clearly limitations in the ADPH studies, they are still actual measurements from the community, and the results are consistent with the results from the risk assessment. Blood lead testing is the most widely accepted and best-validated biomonitoring tool for assessing lead exposure in individuals and communities (CDC 2002). A risk assessment is one way to evaluate the potential for exposure to the community as a whole based on environmental conditions and people's habits and activities, but a risk assessment cannot provide information on individual exposures. It is appropriate for environmental assessments to be conducted for individuals with elevated blood lead levels in conjunction with a biomonitoring program. All community members have access to blood lead testing through Maniilaq. In the event that an individual is determined to have an elevated blood lead level, Maniilaq could investigate the potential source of exposure for that individual using the appropriate CDC and public health protocols. The discussion of limitations with these studies has been expanded in Section 5.4.3 of the HHRA as follows: 1) As agreed upon with DEC during the comment resolution conference call on January 30, 2006, we modified the paragraph leading up to the bullet points at the end of Section 5.4.3.4 to say: "*Although interpretation of the results of the 2004 blood lead survey from a population level standpoint is limited by the small*	Response is acceptable.

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				numbers of participants and the lack of data for small children (0-6 years old), the survey data are consistent with the following observations." 2) The second paragraph of Section 5.4.3.4 has been modified as follows to provide additional description of the results the most recent blood lead study as follows: "*None of the 58 individuals had a blood lead level exceeding 10 µg/dL. Among the Kivalina participants, the geometric mean blood lead among individuals over 18 years of age was 1.1 µg/dL, with individual blood lead levels ranging from less than 1 up to 7 µg/dL. Among Noatak residents, the geometric mean blood lead among individuals over 18 years of age was 1.7 µg/dL, with individual blood lead levels also ranging from less than 1 up to 7 µg/dL. It is noteworthy that the geometric mean values in both Kivalina and Noatak are less than or equal to the geometric mean for adult women estimated by the ALM for this risk assessment. As shown in Table 5-17, the ALM predicted geometric means of 1.9 µg/dL and 1.7 µg/dL for the 30 percent and 9.7 percent bioavailability scenarios, respectively. Blood cadmium levels were similarly low.*" *CDC. 2002. Managing Elevated Blood Lead Levels Among Young Children: Recommendations from the Advisory Committee on Childhood Lead Poisoning Prevention. Centers for Disease Control and Prevention, U.S. Department of Health and Human Services.*	
CSP2-55:	**5.4.3.4 Estimated fish and caribou CoPCs** see discussion of section **5.2.1.2.6.2 6.7.2 Freshwater habitats** should consider the possibility of runoff from contaminated soil carrying metals into ponds and streams, whether they or temporary or permanent water bodies. This is a potential pathway, as animals might consume or live in temporary ponds filled with contaminated runoff water (in particular, when metals-laden snow melts in the spring, filling depressions which feed and water growing plants, animals, and the plants that animals eat, which do most of their growing in the spring).	Medium	Any seasonal elements of risk that were not evaluated in the ERA should be clearly identified and discussed in the uncertainty section. The need for follow-up investigations to address these uncertainties should be seriously considered.	The potential for elevated concentrations to occur in snowmelt has been preliminarily assessed in a USGS study by Brabets (2004). The study found no instances where drinking water or aquatic life standards were exceeded in stream water or snow samples. This information was added to the uncertainty discussion in the risk assessment. The possible need for future studies will be evaluated during development of the risk management plan. The following paragraph was added to the end of Section 6.6.5.1.3 (Time Use) to address this comment: *The potential for elevated concentrations to occur during the period of snowmelt has been preliminarily assessed in a USGS study by Brabets (2004). The study found no exceedances of drinking water or aquatic life standards in stream water or snow samples. Therefore, wildlife that utilize the DMTS during periods of snowmelt would not likely be acutely affected through dietary exposure. Nevertheless, the possible need for future studies will be evaluated during development of the risk management plan, as described in Section 7.3.*	Response is acceptable.
CSP2-56:	**6.7.3 Coastal lagoons** see discussion of section **4.2.3**, regarding whether or not fish live in coastal lagoons. **Appendix A, figure A-3** includes a note stating "Surface water samples at stream stations will be collected separately as part of regular monitoring by Teck Cominco". This data becomes the basis for all of the freshwater stream assessments (CoPC screening, comparisons with references and water quality standards). How were their stations chosen? How were the samples taken?	Low	Please respond to the questions in the comment.	Please refer to response to Comment CSP2-41. Figure 3-4 shows the water sampling locations. On streams that cross the DMTS road, stations were sampled both upstream and downstream of the road to assess effects on water quality from road runoff. These stations were sampled by Teck Cominco on a bimonthly basis throughout the season when streams were flowing. Please refer to Section 3.2.4.3, and Appendix C for data tabulation.	Response is acceptable.
CSP2-57:	**Appendix C** does not include *any* reference data for fish tissue (site data is in **table C-23**)	Medium	Please include the appropriate reference data.	Fish were collected by ADFG in 2002 (please refer to Section 6.3.4.2); the data are presented in Table C-23 (please note that all Appendix C tables have been footnoted with the data sources). Fish were sampled at stations located upstream and downstream of the DMTS road in order to investigate the road's potential effect on fish tissue metals concentrations. Creeks near the mine (Buddy Creek, North Fork Red	Response is acceptable.

No.	Comment	Priority	Recommendation	Response	DEC Remarks
				Dog Creek, and Mainstem Red Dog Creek) were also sampled. The residence time of juvenile Dolly Varden in these creeks in not known, but for most sites, fish depart from their rearing areas in the fall to overwinter in lower reaches of the drainages and return to the sites in mid-June (Ott and Morris 2004). Reference data were not available; however, fish were sampled at stations located upstream and downstream of the DMTS road in order to investigate the road's potential effect on fish tissue metals concentrations. Reference data were only used in the HHRA as part of the screening process for environmental media (i.e., soil, water, and sediment). Animal and plant tissue reference data are available for some species, but these data play no part in risk estimates. Only site data were used to estimate risks. Thus, a lack of fish reference data has no implication on risk assessment results.	
CSP2-58:	**Table 3-3** shows the sample coverage (number of samples) for site (onsite) and reference (offsite) data that were used in the CoPC screening. Several of the metals have very small sample sizes and few locations. There may be too few in some cases to be able to screen out risks to that pathway with statistical confidence. Should reflect how many of each sample by analyte come from each survey – for example: terrestrial/tundra soil/site **Pb** **Phase1RA** approx 15 **PSCHAR** approx 250 **EnSR92** approx 30 Approximations are derived from appendix C, table C-3.	Medium	Please provide response regarding sample-size limitations and how they impact the power of statistical comparisons between the site and reference areas.	Comparisons were not made if sample sizes were unsuitable for statistical comparisons. Please refer also to response to comment CSP2-27.	Response is acceptable.
CSP2-59:	**Figures 5-3 and 5-4** report subsistence areas from a 1983 source, or areas defined more than twenty years ago	Medium	Please use the most up-to-date information available.	The most recent approved subsistence use information is used in the risk assessment. The text in Section 5.2.1.1, in conjunction with Figure 5-3 and 5-4, clearly describes 1) the area used to represent the site, 2) the entire subsistence use area, and 3) the calculation based on those areas used to estimate fractional intake.	Response is acceptable.

Notes: Please note that RA text quoted herein may differ from that in other comment response documents, and in comparison with the final RA document, as a result of successive revisions made during the comment resolution process.

Comments were prepared by Amy Crook (CSP2) and Erin Steinkruger (ACAT) and were submitted on behalf of the following groups: Alaska Community Action on Toxics; Alaskans for Responsible Mining; Trustees for Alaska; Northern Alaska Environment Center; Alaska Center for the Environment; National Parks Conservation Association; Alaska Conservation Voters; and Alaska Conservation Alliance. Dr. Daniel Peplow, University of Washington, provided input to the comments.

See original comment letter from CSP2 for full citations of cited literature.

ACAT - Alaska Community Action on Toxics
ADFG - Alaska Department of Fish and Game
CSP2 - Center for Science in Public Participation
DEC - Department of Environmental Conservation (Alaska)
ERA - ecological risk assessment
FI - fractional intake
HHRA - human health risk assessment
HI - hazard index
HQ - hazard quotient
IEUBK - integrated exposure uptake/biokinetic model
NA - not applicable
RA - risk assessment
TC - Teck Cominco

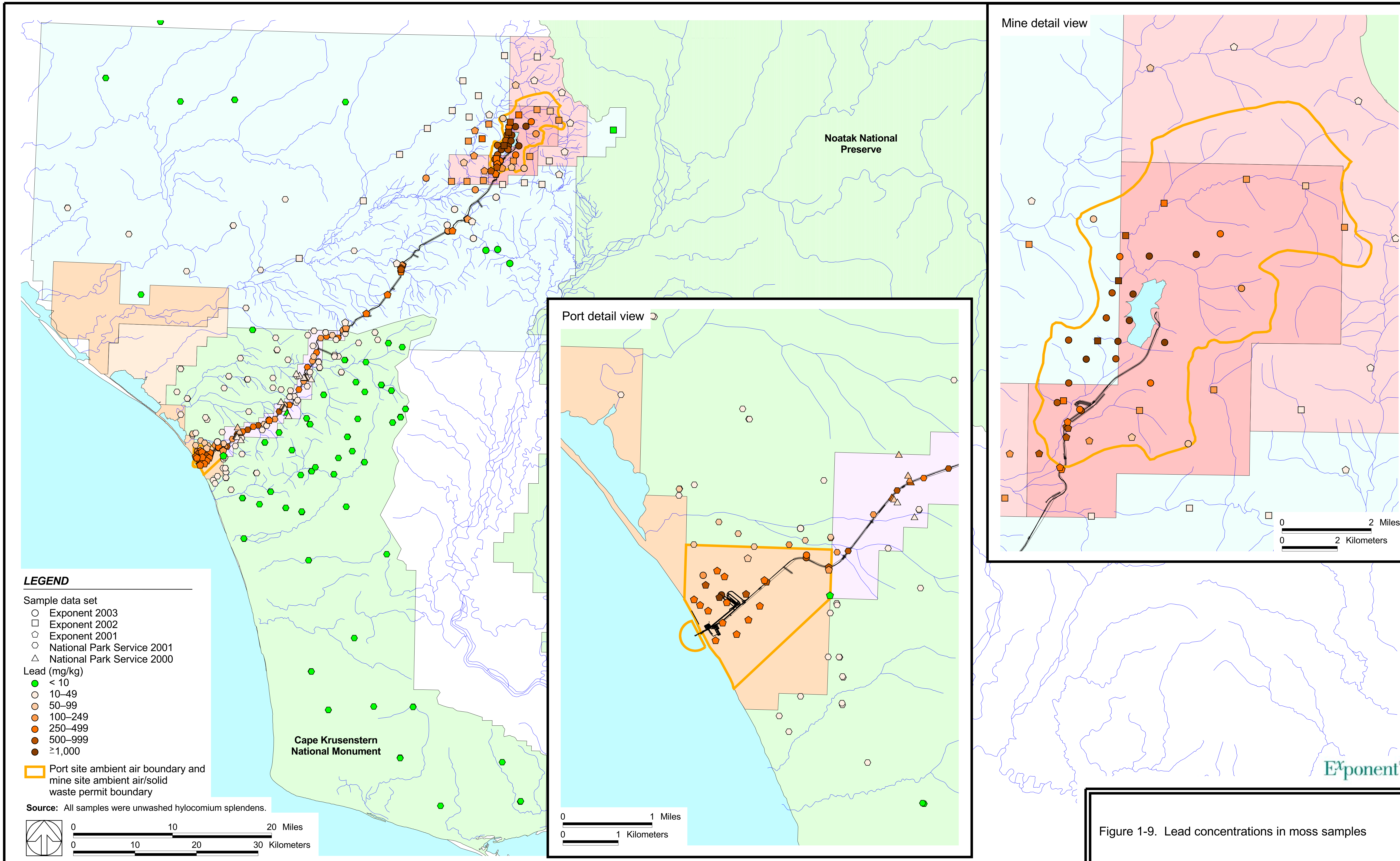

Figure 1-9. Lead concentrations in moss samples

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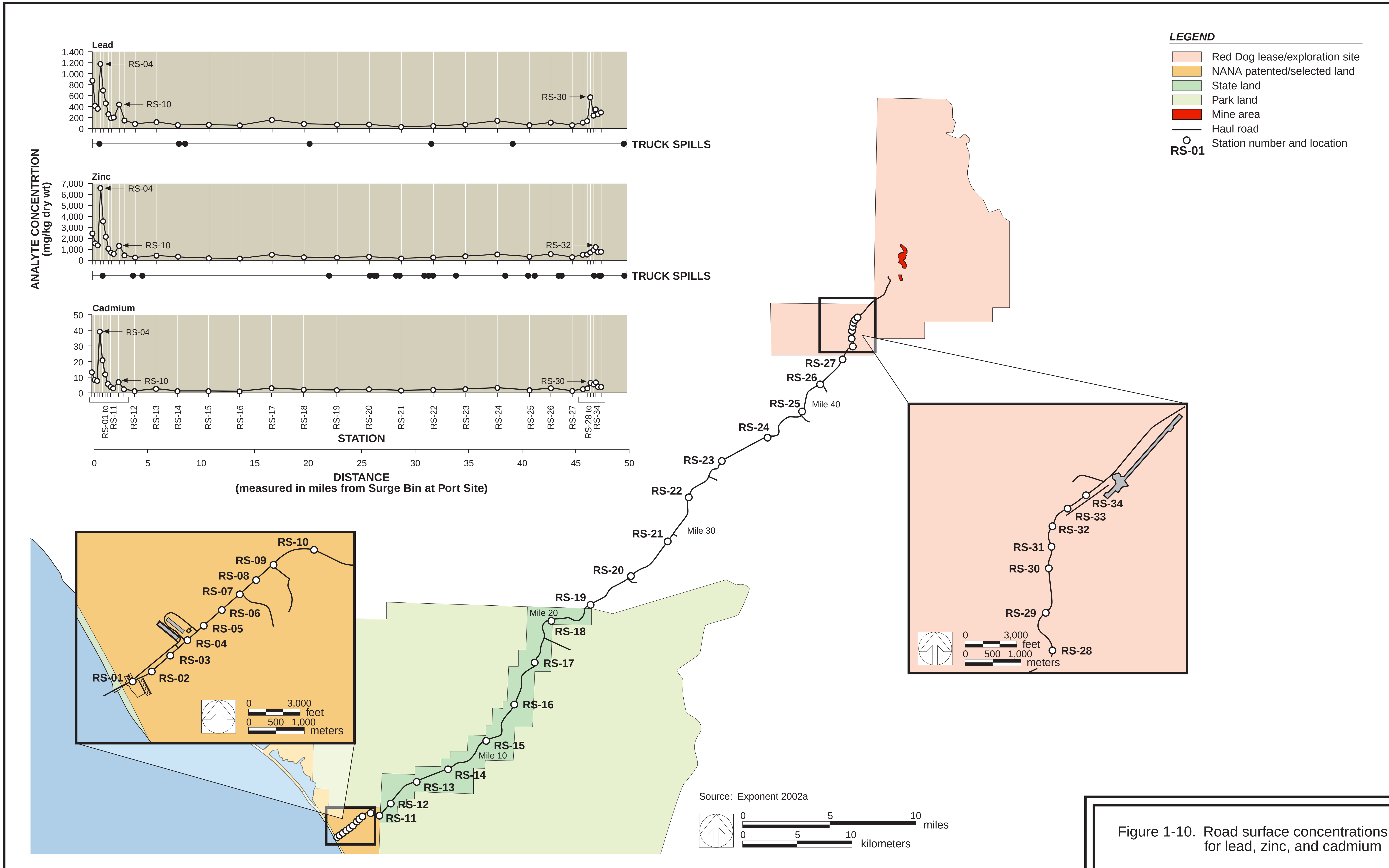

Figure 1-10. Road surface concentrations for lead, zinc, and cadmium

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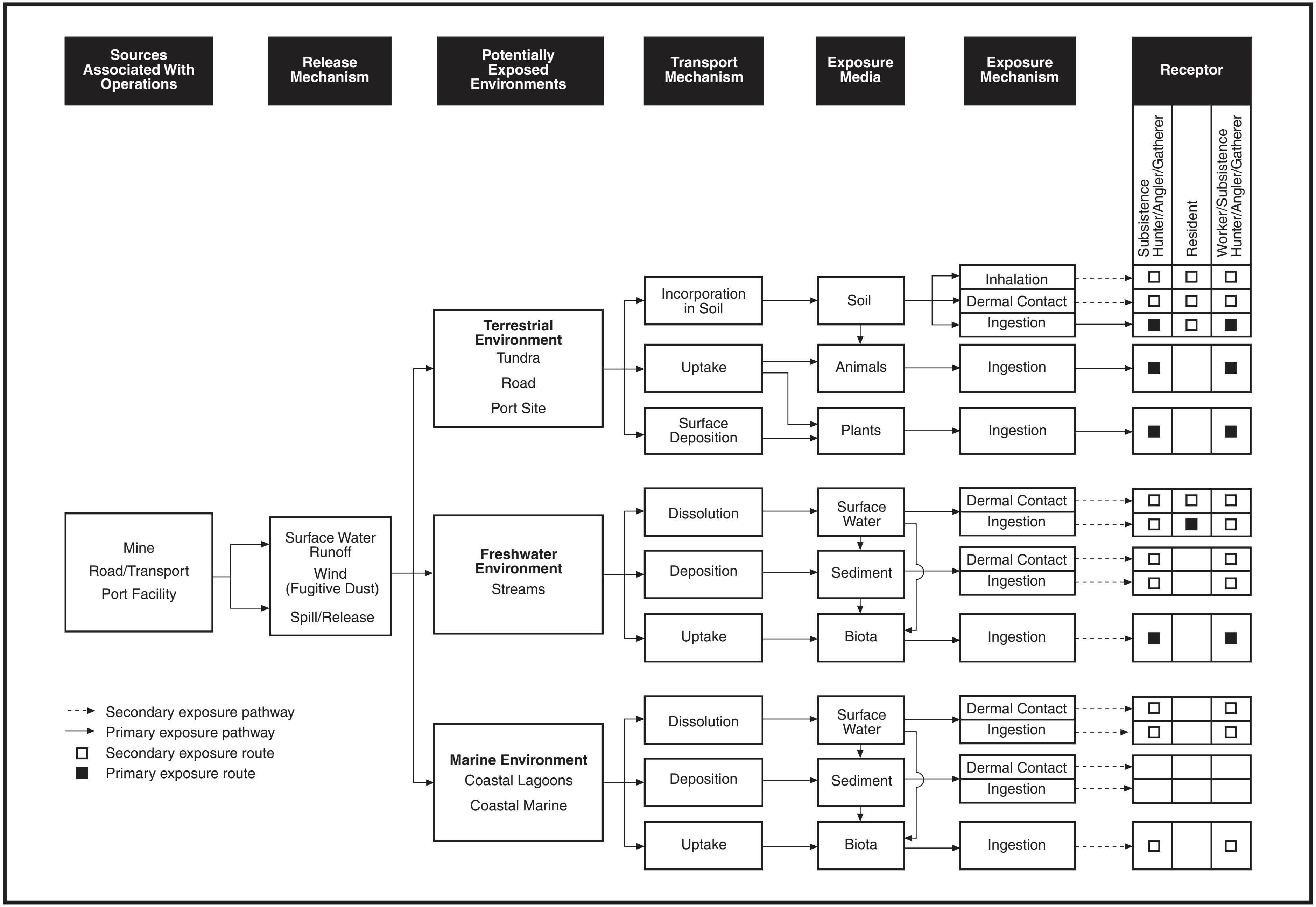

Figure 5-1. Refined conceptual site model for the DMTS human health risk assessment

Table CK1. Comparison of tissue threshold concentrations in moss samples (*Hylocomium splendens*)

	Station	Zone	Sample ID	Event	Copper	Tissue Threshold Concentrations[a]	Zinc	Tissue Threshold Concentrations[a]
					mg/kg	A = 25 - 60	μg/g	A = 150 - 290
					dry	B = 35 - 90	dry	B = 190 - 350
						C = 70 - 110		C = 300 - 400
Site								
	001P-M01	ECO-R	001P-M-01	2001			1530	C
	002P-M01	ECO-R	002P-M-01	2001			1970	C
	003P-M01	ECO-R	003P-M-01	2001			2060	C
	004P-M01	ECO-R	004P-M-01	2001			1420	C
	005P-M01	ECO-R	005P-M-01	2001			2090	C
	006P-M01	ECO-R	006P-M-01	2001			1970	C
	007P-M01	ECO-R	007P-M-01	2001			1280	C
	008P-M01	ECO-R	008P-M-01	2001			1330	C
	009D-M01	ECO-R	009D-M-01	2001			3440	C
	009P-M01	ECO-R	009P-M-01	2001			3210	C
	010P-M01	ECO-R	010P-M-01	2001			2490	C
	011P-M01	ECO-R	011P-M-01	2001			1110	C
	013P-M01	ECO-R	013P-M-01	2001			1450	C
	015P-M01	ECO-R	015P-M-01	2001			424	C
	016P-M01	ECO-R	016P-M-01	2001			1160	C
	017P-M01	ECO-R	017P-M-01	2001			191	B
	018D-M01	ECO-R	018D-M-01	2001			261	B
	018P-M01	ECO-R	018P-M-01	2001			264	B
	019P-M01	ECO-R	019P-M-01	2001			518	C
	020P-M01	ECO-R	020P-M-01	2001			901	C
	021P-M01	ECO-R	021P-M-01	2001			1250	C
	022P-M01	ECO-R	022P-M-01	2001			602	C
	023P-M01	ECO-R	023P-M-01	2001			981	C
	024P-M01	ECO-R	024P-M-01	2001			1140	C
	025P-M01	ECO-R	025P-M-01	2001			862	C
	026D-M01	ECO-R	026D-M-01	2001			420	C
	026P-M01	ECO-R	026P-M-01	2001			290	B
	028P-M01	ECO-R	028P-M-01	2001			922	C
	029P-M01	ECO-R	029P-M-01	2001			119	
	030P-M01	ECO-R	030P-M-01	2001			209	B
	030R-M01	ECO-R	030R-M-01	2001			124	
	031P-M01	ECO-R	031P-M-01	2001			301	C
	031R-M01	ECO-R	031R-M-01	2001			348	C
	032P-M01	ECO-R	032P-M-01	2001			207	B
	032R-M01	ECO-R	032R-M-01	2001			169	A
	033P-M01	ECO-R	033P-M-01	2001			117	
	034D-M01	ECO-R	034D-M-01	2001			93.6	
	034P-M01	ECO-R	034P-M-01	2001			109	
	034R-M01	ECO-R	034R-M-01	2001			97.3	
	035P-M01	ECO-R	035P-M-01	2001			92.5	
	036P-M01	ECO-R	036P-M-01	2001			559	C
	036R-M01	ECO-R	036R-M-01	2001			436	C
	037P-M01	ECO-R	037P-M-01	2001			179	A
	038P-M01	ECO-R	038P-M-01	2001			116	
	038R-M01	ECO-R	038R-M-01	2001			153	A
	039P-M01	ECO-R	039P-M-01	2001			187	A
	040P-M01	ECO-R	040P-M-01	2001			72.3	
	040R-M01	ECO-R	040R-M-01	2001			71.9	

Table CK1. (cont.)

Station	Zone	Sample ID	Event	Copper	Tissue Threshold Concentrations[a]	Zinc	Tissue Threshold Concentrations[a]
				mg/kg	A = 25 - 60	μg/g	A = 150 - 290
				dry	B = 35 - 90	dry	B = 190 - 350
					C = 70 - 110		C = 300 - 400
041P-M01	ECO-R	041P-M-01	2001			309	C
042D-M01	ECO-R	042D-M-01	2001			84.2	
042P-M01	ECO-R	042P-M-01	2001			83	
042R-M01	ECO-R	042R-M-01	2001			82.9	
044P-M01	ECO-R	044P-M-01	2001			230	B
044R-M01	ECO-R	044R-M-01	2001			184	A
045P-M01	ECO-R	045P-M-01	2001			74.4	
046P-M01	ECO-R	046P-M-01	2001			223	B
048P-M01	ECO-R	048P-M-01	2001			129	
048R-M01	ECO-R	048R-M-01	2001			148	
050P-M01	ECO-P	050P-M-01	2001			377	C
051A-M01	ECO-P	051A-M-01	2001			358	C
052P-M01	ECO-P	052P-M-01	2001			637	C
053D-M01	ECO-P	053D-M-01	2001			197	B
053P-M01	ECO-P	053P-M-01	2001			193	B
059D-M01	ECO-P	059D-M-01	2001			300	B
059P-M01	ECO-P	059P-M-01	2001			384	C
060P-M01	ECO-P	060P-M-01	2001			340	C
102P-M01	ECO-R	102P-M-01	2001			141	
103P-M01	ECO-R	103P-M-01	2001			85.6	
116P-M01	ECO-R	116P-M-01	2001			87.8	
117P-M01	ECO-R	117P-M-01	2001			101	
117R-M01	ECO-R	117R-M-01	2001			119	
161P-M01	ECO-P	161P-M-01	2001			128	
161R-M01	ECO-P	161R-M-01	2001			156	A
201P-M01	ECO-R	201P-M-01	2001			132	
HR01-01A	ECO-P	HR-01-01-M	2001			4180	C
HR01-02M	ECO-P	HR-01-02-M	2001			2040	C
HR01-03M	ECO-P	HR-01-03-M	2001			273	B
HR02-01M	ECO-P	HR-02-01-M	2001			3140	C
HR02-02M	ECO-P	HR-02-02-M	2001			949	C
HR02-03M	ECO-P	HR-02-03-M	2001			59.2	
HR03-01M	ECO-R	HR-03-01-M	2001			1160	C
HR03-02M	ECO-R	HR-03-02-M	2001			435	C
HR03-03M	ECO-R	HR-03-03-M	2001			164	A
HR04-01B	ECO-R	HR-04-01-M	2001			1240	C
HR04-02M	ECO-R	HR-04-02-M	2001			889	C
HR04-03M	ECO-R	HR-04-03-M	2001			167	A
HR05-01M	ECO-R	HR-05-01-M	2001			1360	C
HR05-02M	ECO-R	HR-05-02-M	2001			460	C
HR05-03M	ECO-R	HR-05-03-M	2001			118	
HR06-01M	ECO-M	HR-06-01-M	2001			1440	C
HR06-02M	ECO-M	HR-06-02-M	2001			1200	C
HR06-03M	ECO-M	HR-06-03-M	2001			1450	C
HR06-04M	ECO-M	HR-06-04-M	2001			433	C
HS1N0003	ECO-R	HS-1N-0003-M	2000			1570	C
HS1N0050	ECO-R	HS-1N-0050-M	2000			1020	C
HS1N0100	ECO-R	HS-1N-0100-M	2000			554	C
HS1N0250	ECO-R	HS-1N-0250-M	2000			281	B

Table CK1. (cont.)

Station	Zone	Sample ID	Event	Copper	Tissue Threshold Concentrations[a]	Zinc		Tissue Threshold Concentrations[a]
				mg/kg	A = 25 - 60	μg/g		A = 150 - 290
				dry	B = 35 - 90	dry		B = 190 - 350
					C = 70 - 110			C = 300 - 400
HS1N1000	ECO-R	HS-1N-1000-M	2000			153		
HS1S0003	ECO-R	HS-1S-0003-M	2000			1500		C
HS1S0050	ECO-R	HS-1S-0050-M	2000			352		C
HS1S0100	ECO-R	HS-1S-0100-M	2000			207		B
HS1S0250	ECO-R	HS-1S-0250-M	2000			148		
HS1S1000	ECO-R	HS-1S-1000-M	2000			111		
HS1S1600	ECO-R	HS-1S-1600-M	2000			96.1		
HS2N0003	ECO-R	HS-2N-0003-M	2000			2750		C
HS2N0050	ECO-R	HS-2N-0050-M	2000			1880		C
HS2N0100	ECO-R	HS-2N-0100-M	2000			1040		C
HS2N0250	ECO-R	HS-2N-0250-M	2000			516		C
HS2N1000	ECO-R	HS-2N-1000-M	2000			237		B
HS2S0003	ECO-R	HS-2S-0003-M	2000			1200		C
HS2S0050	ECO-R	HS-2S-0050-M	2000			321		C
HS2S0100	ECO-R	HS-2S-0100-M	2000			255		B
HS2S0250	ECO-R	HS-2S-0250-M	2000			138		
HS2S1000	ECO-R	HS-2S-1000-M	2000			118		
HS3N0003	ECO-R	HS-3N-0003-M	2000			1180		C
HS3N0050	ECO-R	HS-3N-0050-M	2000			856		C
HS3N0100	ECO-R	HS-3N-0100-M	2000			695		C
HS3N0250	ECO-R	HS-3N-0250-M	2000			259		B
HS3N1000	ECO-R	HS-3N-1000-M	2000			158		A
HS3N1600	ECO-R	HS-3N-1600-M	2000			169		A
HS3S0003	ECO-R	HS-3S-0003-M	2000			2860		C
HS3S0050	ECO-R	HS-3S-0050-M	2000			751		C
HS3S0100	ECO-R	HS-3S-0100-M	2000			453		C
HS3S0250	ECO-R	HS-3S-0250-M	2000			222		B
HS3S1000	ECO-R	HS-3S-1000-M	2000			112		
MI-02M	ECO-M	MI-02-M	2001			589		C
MI-104	ECO-R	MS0024	2003			74.5		
MI-107	ECO-R	MS0020	2003			137		
MI-108	ECO-R	MS0023	2003			386		C
MI-25-M	ECO-R	MI-25-M	2002			440		C
MI-26-M	ECO-R	MI-26-M	2002			166		A
MI-42-M	ECO-M	MI-42-M	2002			611		C
MI-45-M	ECO-M	MI-45-M	2002			748		C
PO-01M	ECO-P	PO-01-M	2001			1370	*J*	C
PO-02M	ECO-P	PO-02-M	2001			2540	*J*	C
PO-04M	ECO-P	PO-04-M	2001			2090	*J*	C
PO-05M	ECO-P	PO-05-M	2001			6480	*J*	C
PO-06M	ECO-P	PO-06-M	2001			3950	*J*	C
PO-07M	ECO-P	PO-07-M	2001			1580	*J*	C
PO-09M	ECO-P	PO-09-M	2001			1560	*J*	C
PO-10M	ECO-P	PO-10-M	2001			1930	*J*	C
PO-11M	ECO-P	PO-11-M	2001			1260	*J*	C
PO-13M	ECO-P	PO-13-M	2001			1580	*J*	C
PO-15M	ECO-P	PO-15-M	2001			1500	*J*	C
PO-16M	ECO-P	PO-16-M	2001			1520	*J*	C
PO-17M	ECO-P	PO-17-M	2001			1550	*J*	C

Table CK1. (cont.)

Station	Zone	Sample ID	Event	Copper	Tissue Threshold Concentrations[a]	Zinc		Tissue Threshold Concentrations[a]
				mg/kg	A = 25 - 60	μg/g		A = 150 - 290
				dry	B = 35 - 90	dry		B = 190 - 350
					C = 70 - 110			C = 300 - 400
PO-18M	ECO-P	PO-18-M	2001			1480	*J*	C
TT1-0100	ECO-P	MS0005	2003	24.2		8120		C
TT1-1000	ECO-P	MS0008	2003	4.56		869		C
TT2-0010	ECO-P	MS0004	2003	21.6		2910		C
TT2-0100	ECO-P	MS0003	2003	13.1		1340		C
TT2-1000	ECO-P	MS0006	2003	3.85		251		B
TT3-0010	ECO-R	MS0002	2003	16.8		1110		C
TT3-0100	ECO-R	MS0001	2003	9.73		595		C
TT3-1000	ECO-R	MS0015	2003	3.49		135		
Reference								
TS-REF-7	ECOREF	MS0011	2003	3.73		47.9		
TS-REF-8	ECOREF	MS0010	2003	4.35		64		
TS-REF10	ECOREF	MS0009	2003	3.29		55		

Note: [a] Tissue threshold concentration ranges defined as follows based on effects thresholds reported for multiple species in Folkeson and Andersson-Bringmark (1988).

A - exceeds minimum threshold for first signs of reduction in cover
B - exceeds minimum threshold for obvious reductions in cover
C - exceeds minimum apparent survival thresholds (some dead individuals observed)

Both site and literature reference samples were unwashed.

J - estimated value

Data Sources: Exponent (2002a)
Ford and Hasselbach (2001)
Exponent (2003c) and Appendix A of this document
Further detail is provided in Appendix Table C-21

Table CK2. Comparison of tissue threshold concentrations in lichen samples

	Station	Sample ID	Event	Taxon	Zinc		Tissue Threshold Concentrations[a]
					μg/g dry		A = 480 - 1,300 B = 550 - 1,800 C = 600 - 2,200
Site							
	HR01-02L	HR-01-02-L	2001	*Peltigera*	1610		C
	HR02-02L	HR-02-02-L	2001	*Peltigera*	545	*J*	A
	HR02-03L	HR-02-03-L	2001	*Peltigera*	82.2	*J*	
	HR03-03L	HR-03-03-L	2001	*Peltigera*	115	*J*	
	HR05-03L	HR-05-03-L	2001	*Peltigera*	85.2	*J*	
	HR07-01B	HR-07-01-L	2001	*Peltigera*	1720	*J*	C
	HR07-02L	HR-07-02-L	2001	*Peltigera*	1040	*J*	C
	HR07-03L	HR-07-03-L	2001	*Peltigera*	185	*J*	
	HR07-04L	HR-07-04-L	2001	*Peltigera*	121	*J*	
	PO-04L	PO-04-L	2001	*Peltigera*	1010	*J*	C
	PO-11L	PO-11-L	2001	*Peltigera*	1020	*J*	C
	PO-17L	PO-17-L	2001	*Peltigera*	1050	*J*	C
	TT2-0010	LI0018	2004	*Peltigera*	780		C
	TT2-0100	LI0008	2004	*Peltigera*	292		
	TT2-1000	LI0007	2004	*Peltigera*	137		
	TT3-0010	LI0010	2004	*Peltigera*	209		
	TT3-0100	LI0037	2004	*Peltigera*	119	*J*	
	TT3-1000	LI0016	2004	*Cladina*	81.9		
	TT3-1000	LI0017	2004	*Peltigera*	94.4		
	TT5-0010	LI0038	2004	*Peltigera*	594		B
	TT5-0100	LI0006	2004	*Peltigera*	572		B
	TT5-1000	LI0002	2004	*Peltigera*	531		A
	TT5-2000	LI0019	2004	*Cladina*	278		
	TT6-0010	LI0034-D	2004	*Peltigera*	351	*J*	
	TT6-0010	LI0036	2004	*Cladina*	317	*J*	
	TT6-0100	LI0022	2004	*Cladina*	420	*J*	
	TT6-0100	LI0023	2004	*Peltigera*	392	*J*	
	TT6-1000	LI0020	2004	*Peltigera*	335	*J*	
	TT6-1000	LI0021	2004	*Cladina*	386	*J*	
	TT6-2000	LI0026	2004	*Peltigera*	163	*J*	
	TT6-2000	LI0027	2004	*Cladina*	141	*J*	
	TT7-0010	LI0025	2004	*Cladina*	2740	*J*	C
	TT7-1000	LI0024	2004	*Cladina*	996	*J*	C
	TT7-2000	LI0039	2004	*Cladina*	1260		C
	TT8-0010	LI0015	2004	*Peltigera*	627		C
	TT8-0100	LI0014	2004	*Peltigera*	397		
	TT8-1000	LI0011	2004	*Cladina*	70		
	TT8-1000	LI0012-D	2004	*Peltigera*	149		
Reference							
	TS-REF-5	LI0028	2004	*Cladina*	45.2		
	TS-REF-5	LI0029	2004	*Peltigera*	48.5		
	TS-REF-7	LI0030	2004	*Cladina*	26.9		
	TS-REF-7	LI0031	2004	*Peltigera*	39.2		
	TS-REF11	LI0032	2004	*Cladina*	19.4	*J*	
	TS-REF11	LI0033	2004	*Peltigera*	29.7	*J*	

Notes on following page